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Hilfstafeln

zur

Zehnstelligen Logarithmentafel

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to the

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Verbesserung der ersten Differenz

Horizontal-Argument: Zweite Differenz
Vertikal-Argument: Phase

In nachfolgender Tafel kann von jeder Interpolation abgesehen werden, wenn die letzte Stelle des gesuchten Logarithmus bis zu 2.5 Einheiten (Höchstfehler bei zweiten Differenzen nahe 1000 und bei großer Phase) unrichtig sein darf; man nehme dann also z. B. bei zweiter Differenz 986 und Phase 0.5143 mit den Argumenten 990 und 0.51 rund 243, nicht den strengen Wert 240, als „Verbesserung der ersten Differenz".

Verbesserung der ersten Differenz

Phase	Zweite Differenz										
	0	10	20	30	40	50	60	70	80	90	100
0.00	0	5	10	15	20	25	30	35	40	45	50
01	0	5	10	15	20	25	30	35	40	45	49
02	0	5	10	15	20	24	29	34	39	44	49
03	0	5	10	15	19	24	29	34	39	44	48
04	0	5	10	14	19	24	29	34	38	43	48
05	0	5	10	14	19	24	28	33	38	43	47
06	0	5	9	14	19	23	28	33	38	42	47
07	0	5	9	14	19	23	28	33	37	42	46
08	0	5	9	14	18	23	28	32	37	41	46
09	0	5	9	14	18	23	27	32	36	41	45
0.10	0	4	9	13	18	22	27	31	36	40	45
11	0	4	9	13	18	22	27	31	36	40	44
12	0	4	9	13	18	22	26	31	35	40	44
13	0	4	9	13	17	22	26	30	35	39	43
14	0	4	9	13	17	21	26	30	34	39	43
15	0	4	8	13	17	21	25	30	34	38	42
16	0	4	8	13	17	21	25	29	34	38	42
17	0	4	8	12	17	21	25	29	33	37	41
18	0	4	8	12	16	20	25	29	33	37	41
19	0	4	8	12	16	20	24	28	32	36	40
0.20	0	4	8	12	16	20	24	28	32	36	40
21	0	4	8	12	16	20	24	28	32	36	39
22	0	4	8	12	16	19	23	27	31	35	39
23	0	4	8	12	15	19	23	27	31	35	38
24	0	4	8	11	15	19	23	27	30	34	38
25	0	4	7	11	15	19	22	26	30	34	37
26	0	4	7	11	15	18	22	26	30	33	37
27	0	4	7	11	15	18	22	26	29	33	36
28	0	4	7	11	14	18	22	25	29	32	36
29	0	4	7	11	14	18	21	25	28	32	35
0.30	0	3	7	10	14	17	21	24	28	31	35
31	0	3	7	10	14	17	21	24	28	31	34
32	0	3	7	10	14	17	20	24	27	31	34
33	0	3	7	10	13	17	20	23	27	30	33
34	0	3	7	10	13	16	20	23	26	30	33
35	0	3	6	10	13	16	19	23	26	29	32
36	0	3	6	10	13	16	19	22	26	29	32
37	0	3	6	9	13	16	19	22	25	28	31
38	0	3	6	9	12	15	19	22	25	28	31
39	0	3	6	9	12	15	18	21	24	27	30
0.40	0	3	6	9	12	15	18	21	24	27	30
41	0	3	6	9	12	15	18	21	24	27	29
42	0	3	6	9	12	14	17	20	23	26	29
43	0	3	6	9	11	14	17	20	23	26	28
44	0	3	6	8	11	14	17	20	22	25	28
45	0	3	5	8	11	14	16	19	22	25	27
46	0	3	5	8	11	13	16	19	22	24	27
47	0	3	5	8	11	13	16	19	21	24	26
48	0	3	5	8	10	13	16	18	21	23	26
49	0	3	5	8	10	13	15	18	20	23	25
0.50	0	2	5	7	10	12	15	17	20	22	25

Verbesserung der ersten Differenz

Phase	Zweite Differenz										
	0	10	20	30	40	50	60	70	80	90	100
0.50	0	2	5	7	10	12	15	17	20	22	25
51	0	2	5	7	10	12	15	17	20	22	24
52	0	2	5	7	10	12	14	17	19	22	24
53	0	2	5	7	9	12	14	16	19	21	23
54	0	2	5	7	9	11	14	16	18	21	23
55	0	2	4	7	9	11	13	16	18	20	22
56	0	2	4	7	9	11	13	15	18	20	22
57	0	2	4	6	9	11	13	15	17	19	21
58	0	2	4	6	8	10	13	15	17	19	21
59	0	2	4	6	8	10	12	14	16	18	20
0.60	0	2	4	6	8	10	12	14	16	18	20
61	0	2	4	6	8	10	12	14	16	18	19
62	0	2	4	6	8	9	11	13	15	17	19
63	0	2	4	6	7	9	11	13	15	17	18
64	0	2	4	5	7	9	11	13	14	16	18
65	0	2	3	5	7	9	10	12	14	16	17
66	0	2	3	5	7	8	10	12	14	15	17
67	0	2	3	5	7	8	10	12	13	15	16
68	0	2	3	5	6	8	10	11	13	14	16
69	0	2	3	5	6	8	9	11	12	14	15
0.70	0	1	3	4	6	7	9	10	12	13	15
71	0	1	3	4	6	7	9	10	12	13	14
72	0	1	3	4	6	7	8	10	11	13	14
73	0	1	3	4	5	7	8	9	11	12	13
74	0	1	3	4	5	6	8	9	10	12	13
75	0	1	2	4	5	6	7	9	10	11	12
76	0	1	2	4	5	6	7	8	10	11	12
77	0	1	2	3	5	6	7	8	9	10	11
78	0	1	2	3	4	5	7	8	9	10	11
79	0	1	2	3	4	5	6	7	8	9	10
0.80	0	1	2	3	4	5	6	7	8	9	10
81	0	1	2	3	4	5	6	7	8	9	9
82	0	1	2	3	4	4	5	6	7	8	9
83	0	1	2	3	3	4	5	6	7	8	8
84	0	1	2	2	3	4	5	6	6	7	8
85	0	1	1	2	3	4	4	5	6	7	7
86	0	1	1	2	3	3	4	5	6	6	7
87	0	1	1	2	3	3	4	5	5	6	6
88	0	1	1	2	2	3	4	4	5	5	6
89	0	1	1	2	2	3	3	4	4	5	5
0.90	0	0	1	1	2	2	3	3	4	4	5
91	0	0	1	1	2	2	3	3	4	4	4
92	0	0	1	1	2	2	2	3	3	4	4
93	0	0	1	1	1	2	2	2	3	3	3
94	0	0	1	1	1	1	2	2	2	3	3
95	0	0	0	1	1	1	1	2	2	2	2
96	0	0	0	1	1	1	1	1	2	2	2
97	0	0	0	0	1	1	1	1	1	1	1
98	0	0	0	0	0	0	1	1	1	1	1
99	0	0	0	0	0	0	0	0	0	0	0
1.00	0	0	0	0	0	0	0	0	0	0	0

Verbesserung der ersten Differenz

Phase	Zweite Differenz										
	100	110	120	130	140	150	160	170	180	190	200
0.00	50	55	60	65	70	75	80	85	90	95	100
01	49	54	59	64	69	74	79	84	89	94	99
02	49	54	59	64	69	73	78	83	88	93	98
03	48	53	58	63	68	73	78	82	87	92	97
04	48	53	58	62	67	72	77	82	86	91	96
05	47	52	57	62	66	71	76	81	85	90	95
06	47	52	56	61	66	70	75	80	85	89	94
07	46	51	56	60	65	70	74	79	84	88	93
08	46	51	55	60	64	69	74	78	83	87	92
09	45	50	55	59	64	68	73	77	82	86	91
0.10	45	49	54	58	63	67	72	76	81	85	90
11	44	49	53	58	62	67	71	76	80	85	89
12	44	48	53	57	62	66	70	75	79	84	88
13	43	48	52	57	61	65	70	74	78	83	87
14	43	47	52	56	60	64	69	73	77	82	86
15	42	47	51	55	59	64	68	72	76	81	85
16	42	46	50	55	59	63	67	71	76	80	84
17	41	46	50	54	58	62	66	71	75	79	83
18	41	45	49	53	57	61	66	70	74	78	82
19	40	45	49	53	57	61	65	69	73	77	81
0.20	40	44	48	52	56	60	64	68	72	76	80
21	39	43	47	51	55	59	63	67	71	75	79
22	39	43	47	51	55	58	62	66	70	74	78
23	38	42	46	50	54	58	62	65	69	73	77
24	38	42	46	49	53	57	61	65	68	72	76
25	37	41	45	49	52	56	60	64	67	71	75
26	37	41	44	48	52	55	59	63	67	70	74
27	36	40	44	47	51	55	58	62	66	69	73
28	36	40	43	47	50	54	58	61	65	68	72
29	35	39	43	46	50	53	57	60	64	67	71
0.30	35	38	42	45	49	52	56	59	63	66	70
31	34	38	41	45	48	52	55	59	62	66	69
32	34	37	41	44	48	51	54	58	61	65	68
33	33	37	40	44	47	50	54	57	60	64	67
34	33	36	40	43	46	49	53	56	59	63	66
35	32	36	39	42	45	49	52	55	58	62	65
36	32	35	38	42	45	48	51	54	58	61	64
37	31	35	38	41	44	47	50	54	57	60	63
38	31	34	37	40	43	46	50	53	56	59	62
39	30	34	37	40	43	46	49	52	55	58	61
0.40	30	33	36	39	42	45	48	51	54	57	60
41	29	32	35	38	41	44	47	50	53	56	59
42	29	32	35	38	41	43	46	49	52	55	58
43	28	31	34	37	40	43	46	48	51	54	57
44	28	31	34	36	39	42	45	48	50	53	56
45	27	30	33	36	38	41	44	47	49	52	55
46	27	30	32	35	38	40	43	46	49	51	54
47	26	29	32	34	37	40	42	45	48	50	53
48	26	29	31	34	36	39	42	44	47	49	52
49	25	28	31	33	36	38	41	43	46	48	51
0.50	25	27	30	32	35	37	40	42	45	47	50

Verbesserung der ersten Differenz

Phase	Zweite Differenz										
	100	110	120	130	140	150	160	170	180	190	200
0.50	25	27	30	32	35	37	40	42	45	47	50
51	24	27	29	32	34	37	39	42	44	47	49
52	24	26	29	31	34	36	38	41	43	46	48
53	23	26	28	31	33	35	38	40	42	45	47
54	23	25	28	30	32	34	37	39	41	44	46
55	22	25	27	29	31	34	36	38	40	43	45
56	22	24	26	29	31	33	35	37	40	42	44
57	21	24	26	28	30	32	34	37	39	41	43
58	21	23	25	27	29	31	34	36	38	40	42
59	20	23	25	27	29	31	33	35	37	39	41
0.60	20	22	24	26	28	30	32	34	36	38	40
61	19	21	23	25	27	29	31	33	35	37	39
62	19	21	23	25	27	28	30	32	34	36	38
63	18	20	22	24	26	28	30	31	33	35	37
64	18	20	22	23	25	27	29	31	32	34	36
65	17	19	21	23	24	26	28	30	31	33	35
66	17	19	20	22	24	25	27	29	31	32	34
67	16	18	20	21	23	25	26	28	30	31	33
68	16	18	19	21	22	24	26	27	29	30	32
69	15	17	19	20	22	23	25	26	28	29	31
0.70	15	16	18	19	21	22	24	25	27	28	30
71	14	16	17	19	20	22	23	25	26	28	29
72	14	15	17	18	20	21	22	24	25	27	28
73	13	15	16	18	19	20	22	23	24	26	27
74	13	14	16	17	18	19	21	22	23	25	26
75	12	14	15	16	17	19	20	21	22	24	25
76	12	13	14	16	17	18	19	20	22	23	24
77	11	13	14	15	16	17	18	20	21	22	23
78	11	12	13	14	15	16	18	19	20	21	22
79	10	12	13	14	15	16	17	18	19	20	21
0.80	10	11	12	13	14	15	16	17	18	19	20
81	9	10	11	12	13	14	15	16	17	18	19
82	9	10	11	12	13	13	14	15	16	17	18
83	8	9	10	11	12	13	14	14	15	16	17
84	8	9	10	10	11	12	13	14	14	15	16
85	7	8	9	10	10	11	12	13	13	14	15
86	7	8	8	9	10	10	11	12	13	13	14
87	6	7	8	8	9	10	10	11	12	12	13
88	6	7	7	8	8	9	10	10	11	11	12
89	5	6	7	7	8	8	9	9	10	10	11
0.90	5	5	6	6	7	7	8	8	9	9	10
91	4	5	5	6	6	7	7	8	8	9	9
92	4	4	5	5	6	6	6	7	7	8	8
93	3	4	4	5	5	5	6	6	6	7	7
94	3	3	4	4	4	4	5	5	5	6	6
95	2	3	3	3	3	4	4	4	4	5	5
96	2	2	2	3	3	3	3	3	4	4	4
97	1	2	2	2	2	2	2	3	3	3	3
98	1	1	1	1	1	1	2	2	2	2	2
99	0	1	1	1	1	1	1	1	1	1	1
1.00	0	0	0	0	0	0	0	0	0	0	0

Verbesserung der ersten Differenz

Phase	Zweite Differenz										
	200	210	220	230	240	250	260	270	280	290	300
0.00	100	105	110	115	120	125	130	135	140	145	150
01	99	104	109	114	119	124	129	134	139	144	148
02	98	103	108	113	118	122	127	132	137	142	147
03	97	102	107	112	116	121	126	131	136	141	145
04	96	101	106	110	115	120	125	130	134	139	144
05	95	100	104	109	114	119	123	128	133	138	142
06	94	99	103	108	113	117	122	127	132	136	141
07	93	98	102	107	112	116	121	126	130	135	139
08	92	97	101	106	110	115	120	124	129	133	138
09	91	96	100	105	109	114	118	123	127	132	136
0.10	90	94	99	103	108	112	117	121	126	130	135
11	89	93	98	102	107	111	116	120	125	129	133
12	88	92	97	101	106	110	114	119	123	128	132
13	87	91	96	100	104	109	113	117	122	126	130
14	86	90	95	99	103	107	112	116	120	125	129
15	85	89	93	98	102	106	110	115	119	123	127
16	84	88	92	97	101	105	109	113	118	122	126
17	83	87	91	95	100	104	108	112	116	120	124
18	82	86	90	94	98	102	107	111	115	119	123
19	81	85	89	93	97	101	105	109	113	117	121
0.20	80	84	88	92	96	100	104	108	112	116	120
21	79	83	87	91	95	99	103	107	111	115	118
22	78	82	86	90	94	97	101	105	109	113	117
23	77	81	85	89	92	96	100	104	108	112	115
24	76	80	84	87	91	95	99	103	106	110	114
25	75	79	82	86	90	94	97	101	105	109	112
26	74	78	81	85	89	92	96	100	104	107	111
27	73	77	80	84	88	91	95	99	102	106	109
28	72	76	79	83	86	90	94	97	101	104	108
29	71	75	78	82	85	89	92	96	99	103	106
0.30	70	73	77	80	84	87	91	94	98	101	105
31	69	72	76	79	83	86	90	93	97	100	103
32	68	71	75	78	82	85	88	92	95	99	102
33	67	70	74	77	80	84	87	90	94	97	100
34	66	69	73	76	79	82	86	89	92	96	99
35	65	68	71	75	78	81	84	88	91	94	97
36	64	67	70	74	77	80	83	86	90	93	96
37	63	66	69	72	76	79	82	85	88	91	94
38	62	65	68	71	74	77	81	84	87	90	93
39	61	64	67	70	73	76	79	82	85	88	91
0.40	60	63	66	69	72	75	78	81	84	87	90
41	59	62	65	68	71	74	77	80	83	86	88
42	58	61	64	67	70	72	75	78	81	84	87
43	57	60	63	66	68	71	74	77	80	83	85
44	56	59	62	64	67	70	73	76	78	81	84
45	55	58	60	63	66	69	71	74	77	80	82
46	54	57	59	62	65	67	70	73	76	78	81
47	53	56	58	61	64	66	69	72	74	77	79
48	52	55	57	60	62	65	68	70	73	75	78
49	51	54	56	59	61	64	66	69	71	74	76
0.50	50	52	55	57	60	62	65	67	70	72	75

Verbesserung der ersten Differenz

Phase	Zweite Differenz										
	200	210	220	230	240	250	260	270	280	290	300
0.50	50	52	55	57	60	62	65	67	70	72	75
51	49	51	54	56	59	61	64	66	69	71	73
52	48	50	53	55	58	60	62	65	67	70	72
53	47	49	52	54	56	59	61	63	66	68	70
54	46	48	51	53	55	57	60	62	64	67	69
55	45	47	49	52	54	56	58	61	63	65	67
56	44	46	48	51	53	55	57	59	62	64	66
57	43	45	47	49	52	54	56	58	60	62	64
58	42	44	46	48	50	52	55	57	59	61	63
59	41	43	45	47	49	51	53	55	57	59	61
0.60	40	42	44	46	48	50	52	54	56	58	60
61	39	41	43	45	47	49	51	53	55	57	58
62	38	40	42	44	46	47	49	51	53	55	57
63	37	39	41	43	44	46	48	50	52	54	55
64	36	38	40	41	43	45	47	49	50	52	54
65	35	37	38	40	42	44	45	47	49	51	52
66	34	36	37	39	41	42	44	46	48	49	51
67	33	35	36	38	40	41	43	45	46	48	49
68	32	34	35	37	38	40	42	43	45	46	48
69	31	33	34	36	37	39	40	42	43	45	46
0.70	30	31	33	34	36	37	39	40	42	43	45
71	29	30	32	33	35	36	38	39	41	42	43
72	28	29	31	32	34	35	36	38	39	41	42
73	27	28	30	31	32	34	35	36	38	39	40
74	26	27	29	30	31	32	34	35	36	38	39
75	25	26	27	29	30	31	32	34	35	36	37
76	24	25	26	28	29	30	31	32	34	35	36
77	23	24	25	26	28	29	30	31	32	33	34
78	22	23	24	25	26	27	29	30	31	32	33
79	21	22	23	24	25	26	27	28	29	30	31
0.80	20	21	22	23	24	25	26	27	28	29	30
81	19	20	21	22	23	24	25	26	27	28	28
82	18	19	20	21	22	22	23	24	25	26	27
83	17	18	19	20	20	21	22	23	24	25	25
84	16	17	18	18	19	20	21	22	22	23	24
85	15	16	16	17	18	19	19	20	21	22	22
86	14	15	15	16	17	17	18	19	20	20	21
87	13	14	14	15	16	16	17	18	18	19	19
88	12	13	13	14	14	15	16	16	17	17	18
89	11	12	12	13	13	14	14	15	15	16	16
0.90	10	10	11	11	12	12	13	13	14	14	15
91	9	9	10	10	11	11	12	12	13	13	13
92	8	8	9	9	10	10	10	11	11	12	12
93	7	7	8	8	8	9	9	9	10	10	10
94	6	6	7	7	7	7	8	8	8	9	9
95	5	5	6	6	6	6	6	7	7	7	7
96	4	4	4	5	5	5	5	5	6	6	6
97	3	3	3	3	4	4	4	4	4	4	4
98	2	2	2	2	2	2	3	3	3	3	3
99	1	1	1	1	1	1	1	1	1	1	1
1.00	0	0	0	0	0	0	0	0	0	0	0

Verbesserung der ersten Differenz

Phase	Zweite Differenz										
	300	310	320	330	340	350	360	370	380	390	400
0.00	150	155	160	165	170	175	180	185	190	195	200
01	148	153	158	163	168	173	178	183	188	193	198
02	147	152	157	162	167	171	176	181	186	191	196
03	145	150	155	160	165	170	175	179	184	189	194
04	144	149	154	158	163	168	173	178	182	187	192
05	142	147	152	157	161	166	171	176	180	185	190
06	141	146	150	155	160	164	169	174	179	183	188
07	139	144	149	153	158	163	167	172	177	181	186
08	138	143	147	152	156	161	166	170	175	179	184
09	136	141	146	150	155	159	164	168	173	177	182
0.10	135	139	144	148	153	157	162	166	171	175	180
11	133	138	142	147	151	156	160	165	169	174	178
12	132	136	141	145	150	154	158	163	167	172	176
13	130	135	139	144	148	152	157	161	165	170	174
14	129	133	138	142	146	150	155	159	163	168	172
15	127	132	136	140	144	149	153	157	161	166	170
16	126	130	134	139	143	147	151	155	160	164	168
17	124	129	133	137	141	145	149	154	158	162	166
18	123	127	131	135	139	143	148	152	156	160	164
19	121	126	130	134	138	142	146	150	154	158	162
0.20	120	124	128	132	136	140	144	148	152	156	160
21	118	122	126	130	134	138	142	146	150	154	158
22	117	121	125	129	133	136	140	144	148	152	156
23	115	119	123	127	131	135	139	142	146	150	154
24	114	118	122	125	129	133	137	141	144	148	152
25	112	116	120	124	127	131	135	139	142	146	150
26	111	115	118	122	126	129	133	137	141	144	148
27	109	113	117	120	124	128	131	135	139	142	146
28	108	112	115	119	122	126	130	133	137	140	144
29	106	110	114	117	121	124	128	131	135	138	142
0.30	105	108	112	115	119	122	126	129	133	136	140
31	103	107	110	114	117	121	124	128	131	135	138
32	102	105	109	112	116	119	122	126	129	133	136
33	100	104	107	111	114	117	121	124	127	131	134
34	99	102	106	109	112	115	119	122	125	129	132
35	97	101	104	107	110	114	117	120	123	127	130
36	96	99	102	106	109	112	115	118	122	125	128
37	94	98	101	104	107	110	113	117	120	123	126
38	93	96	99	102	105	108	112	115	118	121	124
39	91	95	98	101	104	107	110	113	116	119	122
0.40	90	93	96	99	102	105	108	111	114	117	120
41	88	91	94	97	100	103	106	109	112	115	118
42	87	90	93	96	99	101	104	107	110	113	116
43	85	88	91	94	97	100	103	105	108	111	114
44	84	87	90	92	95	98	101	104	106	109	112
45	82	85	88	91	93	96	99	102	104	107	110
46	81	84	86	89	92	94	97	100	103	105	108
47	79	82	85	87	90	93	95	98	101	103	106
48	78	81	83	86	88	91	94	96	99	101	104
49	76	79	82	84	87	89	92	94	97	99	102
0.50	75	77	80	82	85	87	90	92	95	97	100

Verbesserung der ersten Differenz

Phase	Zweite Differenz										
	300	310	320	330	340	350	360	370	380	390	400
0.50	75	77	80	82	85	87	90	92	95	97	100
51	73	76	78	81	83	86	88	91	93	96	98
52	72	74	77	79	82	84	86	89	91	94	96
53	70	73	75	78	80	82	85	87	89	92	94
54	69	71	74	76	78	80	83	85	87	90	92
55	67	70	72	74	76	79	81	83	85	88	90
56	66	68	70	73	75	77	79	81	84	86	88
57	64	67	69	71	73	75	77	80	82	84	86
58	63	65	67	69	71	73	76	78	80	82	84
59	61	64	66	68	70	72	74	76	78	80	82
0.60	60	62	64	66	68	70	72	74	76	78	80
61	58	60	62	64	66	68	70	72	74	76	78
62	57	59	61	63	65	66	68	70	72	74	76
63	55	57	59	61	63	65	67	68	70	72	74
64	54	56	58	59	61	63	65	67	68	70	72
65	52	54	56	58	59	61	63	65	66	68	70
66	51	53	54	56	58	59	61	63	65	66	68
67	49	51	53	54	56	58	59	61	63	64	66
68	48	50	51	53	54	56	58	59	61	62	64
69	46	48	50	51	53	54	56	57	59	60	62
0.70	45	46	48	49	51	52	54	55	57	58	60
71	43	45	46	48	49	51	52	54	55	57	58
72	42	43	45	46	48	49	50	52	53	55	56
73	40	42	43	45	46	47	49	50	51	53	54
74	39	40	42	43	44	45	47	48	49	51	52
75	37	39	40	41	42	44	45	46	47	49	50
76	36	37	38	40	41	42	43	44	46	47	48
77	34	36	37	38	39	40	41	43	44	45	46
78	33	34	35	36	37	38	40	41	42	43	44
79	31	33	34	35	36	37	38	39	40	41	42
0.80	30	31	32	33	34	35	36	37	38	39	40
81	28	29	30	31	32	33	34	35	36	37	38
82	27	28	29	30	31	31	32	33	34	35	36
83	25	26	27	28	29	30	31	31	32	33	34
84	24	25	26	26	27	28	29	30	30	31	32
85	22	23	24	25	25	26	27	28	28	29	30
86	21	22	22	23	24	24	25	26	27	27	28
87	19	20	21	21	22	23	23	24	25	25	26
88	18	19	19	20	20	21	22	22	23	23	24
89	16	17	18	18	19	19	20	20	21	21	22
0.90	15	15	16	16	17	17	18	18	19	19	20
91	13	14	14	15	15	16	16	17	17	18	18
92	12	12	13	13	14	14	14	15	15	16	16
93	10	11	11	12	12	12	13	13	13	14	14
94	9	9	10	10	10	10	11	11	11	12	12
95	7	8	8	8	8	9	9	9	9	10	10
96	6	6	6	7	7	7	7	7	8	8	8
97	4	5	5	5	5	5	5	6	6	6	6
98	3	3	3	3	3	3	4	4	4	4	4
99	1	2	2	2	2	2	2	2	2	2	2
1.00	0	0	0	0	0	0	0	0	0	0	0

Verbesserung der ersten Differenz

Phase	Zweite Differenz										
	400	410	420	430	440	450	460	470	480	490	500
0.00	200	205	210	215	220	225	230	235	240	245	250
01	198	203	208	213	218	223	228	233	238	243	247
02	196	201	206	211	216	220	225	230	235	240	245
03	194	199	204	209	213	218	223	228	233	238	242
04	192	197	202	206	211	216	221	226	230	235	240
05	190	195	199	204	209	214	218	223	228	233	237
06	188	193	197	202	207	211	216	221	226	230	235
07	186	191	195	200	205	209	214	219	223	228	232
08	184	189	193	198	202	207	212	216	221	225	230
09	182	187	191	196	200	205	209	214	218	223	227
0.10	180	184	189	193	198	202	207	211	216	220	225
11	178	182	187	191	196	200	205	209	214	218	222
12	176	180	185	189	194	198	202	207	211	216	220
13	174	178	183	187	191	196	200	204	209	213	217
14	172	176	181	185	189	193	198	202	206	211	215
15	170	174	178	183	187	191	195	200	204	208	212
16	168	172	176	181	185	189	193	197	202	206	210
17	166	170	174	178	183	187	191	195	199	203	207
18	164	168	172	176	180	184	189	193	197	201	205
19	162	166	170	174	178	182	186	190	194	198	202
0.20	160	164	168	172	176	180	184	188	192	196	200
21	158	162	166	170	174	178	182	186	190	194	197
22	156	160	164	168	172	175	179	183	187	191	195
23	154	158	162	166	169	173	177	181	185	189	192
24	152	156	160	163	167	171	175	179	182	186	190
25	150	154	157	161	165	169	172	176	180	184	187
26	148	152	155	159	163	166	170	174	178	181	185
27	146	150	153	157	161	164	168	172	175	179	182
28	144	148	151	155	158	162	166	169	173	176	180
29	142	146	149	153	156	160	163	167	170	174	177
0.30	140	143	147	150	154	157	161	164	168	171	175
31	138	141	145	148	152	155	159	162	166	169	172
32	136	139	143	146	150	153	156	160	163	167	170
33	134	137	141	144	147	151	154	157	161	164	167
34	132	135	139	142	145	148	152	155	158	162	165
35	130	133	136	140	143	146	149	153	156	159	162
36	128	131	134	138	141	144	147	150	154	157	160
37	126	129	132	135	139	142	145	148	151	154	157
38	124	127	130	133	136	139	143	146	149	152	155
39	122	125	128	131	134	137	140	143	146	149	152
0.40	120	123	126	129	132	135	138	141	144	147	150
41	118	121	124	127	130	133	136	139	142	145	147
42	116	119	122	125	128	130	133	136	139	142	145
43	114	117	120	123	125	128	131	134	137	140	142
44	112	115	118	120	123	126	129	132	134	137	140
45	110	113	116	118	121	124	126	129	132	135	137
46	108	111	113	116	119	121	124	127	130	132	135
47	106	109	111	114	117	119	122	125	127	130	132
48	104	107	109	112	114	117	120	122	125	127	130
49	102	105	107	110	112	115	117	120	122	125	127
0.50	100	102	105	107	110	112	115	117	120	122	125

Verbesserung der ersten Differenz

Phase	Zweite Differenz										
	400	410	420	430	440	450	460	470	480	490	500
0.50	100	102	105	107	110	112	115	117	120	122	125
51	98	100	103	105	108	110	113	115	118	120	122
52	96	98	101	103	106	108	110	113	115	118	120
53	94	96	99	101	103	106	108	110	113	115	117
54	92	94	97	99	101	103	106	108	110	113	115
55	90	92	94	97	99	101	103	106	108	110	112
56	88	90	92	95	97	99	101	103	106	108	110
57	86	88	90	92	95	97	99	101	103	105	107
58	84	86	88	90	92	94	97	99	101	103	105
59	82	84	86	88	90	92	94	96	98	100	102
0.60	80	82	84	86	88	90	92	94	96	98	100
61	78	80	82	84	86	88	90	92	94	96	97
62	76	78	80	82	84	85	87	89	91	93	95
63	74	76	78	80	81	83	85	87	89	91	92
64	72	74	76	77	79	81	83	85	86	88	90
65	70	72	73	75	77	79	80	82	84	86	87
66	68	70	71	73	75	76	78	80	82	83	85
67	66	68	69	71	73	74	76	78	79	81	82
68	64	66	67	69	70	72	74	75	77	78	80
69	62	64	65	67	68	70	71	73	74	76	77
0.70	60	61	63	64	66	67	69	70	72	73	75
71	58	59	61	62	64	65	67	68	70	71	72
72	56	57	59	60	62	63	64	66	67	69	70
73	54	55	57	58	59	61	62	63	65	66	67
74	52	53	55	56	57	58	60	61	62	64	65
75	50	51	52	54	55	56	57	59	60	61	62
76	48	49	50	52	53	54	55	56	58	59	60
77	46	47	48	49	51	52	53	54	55	56	57
78	44	45	46	47	48	49	51	52	53	54	55
79	42	43	44	45	46	47	48	49	50	51	52
0.80	40	41	42	43	44	45	46	47	48	49	50
81	38	39	40	41	42	43	44	45	46	47	47
82	36	37	38	39	40	40	41	42	43	44	45
83	34	35	36	37	37	38	39	40	41	42	42
84	32	33	34	34	35	36	37	38	38	39	40
85	30	31	31	32	33	34	34	35	36	37	37
86	28	29	29	30	31	31	32	33	34	34	35
87	26	27	27	28	29	29	30	31	31	32	32
88	24	25	25	26	26	27	28	28	29	29	30
89	22	23	23	24	24	25	25	26	26	27	27
0.90	20	20	21	21	22	22	23	23	24	24	25
91	18	18	19	19	20	20	21	21	22	22	22
92	16	16	17	17	18	18	18	19	19	20	20
93	14	14	15	15	15	16	16	16	17	17	17
94	12	12	13	13	13	13	14	14	14	15	15
95	10	10	11	11	11	11	11	12	12	12	12
96	8	8	8	9	9	9	9	9	10	10	10
97	6	6	6	6	7	7	7	7	7	7	7
98	4	4	4	4	4	4	5	5	5	5	5
99	2	2	2	2	2	2	2	2	2	2	2
1.00	0	0	0	0	0	0	0	0	0	0	0

Verbesserung der ersten Differenz

Phase	Zweite Differenz										
	500	510	520	530	540	550	560	570	580	590	600
0.00	250	255	260	265	270	275	280	285	290	295	300
01	247	252	257	262	267	272	277	282	287	292	297
02	245	250	255	260	265	269	274	279	284	289	294
03	242	247	252	257	262	267	272	276	281	286	291
04	240	245	250	254	259	264	269	274	278	283	288
05	237	242	247	252	256	261	266	271	275	280	285
06	235	240	244	249	254	258	263	268	273	277	282
07	232	237	242	246	251	256	260	265	270	274	279
08	230	235	239	244	248	253	258	262	267	271	276
09	227	232	237	241	246	250	255	259	264	268	273
0.10	225	229	234	238	243	247	252	256	261	265	270
11	222	227	231	236	240	245	249	254	258	263	267
12	220	224	229	233	238	242	246	251	255	260	264
13	217	222	226	231	235	239	244	248	252	257	261
14	215	219	224	228	232	236	241	245	249	254	258
15	212	217	221	225	229	234	238	242	246	251	255
16	210	214	218	223	227	231	235	239	244	248	252
17	207	212	216	220	224	228	232	237	241	245	249
18	205	209	213	217	221	225	230	234	238	242	246
19	202	207	211	215	219	223	227	231	235	239	243
0.20	200	204	208	212	216	220	224	228	232	236	240
21	197	201	205	209	213	217	221	225	229	233	237
22	195	199	203	207	211	214	218	222	226	230	234
23	192	196	200	204	208	212	216	219	223	227	231
24	190	194	198	201	205	209	213	217	220	224	228
25	187	191	195	199	202	206	210	214	217	221	225
26	185	189	192	196	200	203	207	211	215	218	222
27	182	186	190	193	197	201	204	208	212	215	219
28	180	184	187	191	194	198	202	205	209	212	216
29	177	181	185	188	192	195	199	202	206	209	213
0.30	175	178	182	185	189	192	196	199	203	206	210
31	172	176	179	183	186	190	193	197	200	204	207
32	170	173	177	180	184	187	190	194	197	201	204
33	167	171	174	178	181	184	188	191	194	198	201
34	165	168	172	175	178	181	185	188	191	195	198
35	162	166	169	172	175	179	182	185	188	192	195
36	160	163	166	170	173	176	179	182	186	189	192
37	157	161	164	167	170	173	176	180	183	186	189
38	155	158	161	164	167	170	174	177	180	183	186
39	152	156	159	162	165	168	171	174	177	180	183
0.40	150	153	156	159	162	165	168	171	174	177	180
41	147	150	153	156	159	162	165	168	171	174	177
42	145	148	151	154	157	159	162	165	168	171	174
43	142	145	148	151	154	157	160	162	165	168	171
44	140	143	146	148	151	154	157	160	162	165	168
45	137	140	143	146	148	151	154	157	159	162	165
46	135	138	140	143	146	148	151	154	157	159	162
47	132	135	138	140	143	146	148	151	154	156	159
48	130	133	135	138	140	143	146	148	151	153	156
49	127	130	133	135	138	140	143	145	148	150	153
0.50	125	127	130	132	135	137	140	142	145	147	150

Verbesserung der ersten Differenz

Phase	Zweite Differenz										
	500	510	520	530	540	550	560	570	580	590	600
0.50	125	127	130	132	135	137	140	142	145	147	150
51	122	125	127	130	132	135	137	140	142	145	147
52	120	122	125	127	130	132	134	137	139	142	144
53	117	120	122	125	127	129	132	134	136	139	141
54	115	117	120	122	124	126	129	131	133	136	138
55	112	115	117	119	121	124	126	128	130	133	135
56	110	112	114	117	119	121	123	125	128	130	132
57	107	110	112	114	116	118	120	123	125	127	129
58	105	107	109	111	113	115	118	120	122	124	126
59	102	105	107	109	111	113	115	117	119	121	123
0.60	100	102	104	106	108	110	112	114	116	118	120
61	97	99	101	103	105	107	109	111	113	115	117
62	95	97	99	101	103	104	106	108	110	112	114
63	92	94	96	98	100	102	104	105	107	109	111
64	90	92	94	95	97	99	101	103	104	106	108
65	87	89	91	93	94	96	98	100	101	103	105
66	85	87	88	90	92	93	95	97	99	100	102
67	82	84	86	87	89	91	92	94	96	97	99
68	80	82	83	85	86	88	90	91	93	94	96
69	77	79	81	82	84	85	87	88	90	91	93
0.70	75	76	78	79	81	82	84	85	87	88	90
71	72	74	75	77	78	80	81	83	84	86	87
72	70	71	73	74	76	77	78	80	81	83	84
73	67	69	70	72	73	74	76	77	78	80	81
74	65	66	68	69	70	71	73	74	75	77	78
75	62	64	65	66	67	69	70	71	72	74	75
76	60	61	62	64	65	66	67	68	70	71	72
77	57	59	60	61	62	63	64	66	67	68	69
78	55	56	57	58	59	60	62	63	64	65	66
79	52	54	55	56	57	58	59	60	61	62	63
0.80	50	51	52	53	54	55	56	57	58	59	60
81	47	48	49	50	51	52	53	54	55	56	57
82	45	46	47	48	49	49	50	51	52	53	54
83	42	43	44	45	46	47	48	48	49	50	51
84	40	41	42	42	43	44	45	46	46	47	48
85	37	38	39	40	40	41	42	43	43	44	45
86	35	36	36	37	38	38	39	40	41	41	42
87	32	33	34	34	35	36	36	37	38	38	39
88	30	31	31	32	32	33	34	34	35	35	36
89	27	28	29	29	30	30	31	31	32	32	33
0.90	25	25	26	26	27	27	28	28	29	29	30
91	22	23	23	24	24	25	25	26	26	27	27
92	20	20	21	21	22	22	22	23	23	24	24
93	17	18	18	19	19	19	20	20	20	21	21
94	15	15	16	16	16	16	17	17	17	18	18
95	12	13	13	13	13	14	14	14	14	15	15
96	10	10	10	11	11	11	11	11	12	12	12
97	7	8	8	8	8	8	8	9	9	9	9
98	5	5	5	5	5	5	6	6	6	6	6
99	2	3	3	3	3	3	3	3	3	3	3
1.00	0	0	0	0	0	0	0	0	0	0	0

Verbesserung der ersten Differenz

Phase	Zweite Differenz										
	600	610	620	630	640	650	660	670	680	690	700
0.00	300	305	310	315	320	325	330	335	340	345	350
01	297	302	307	312	317	322	327	332	337	342	346
02	294	299	304	309	314	318	323	328	333	338	343
03	291	296	301	306	310	315	320	325	330	335	339
04	288	293	298	302	307	312	317	322	326	331	336
05	285	290	294	299	304	309	313	318	323	328	332
06	282	287	291	296	301	305	310	315	320	324	329
07	279	284	288	293	298	302	307	312	316	321	325
08	276	281	285	290	294	299	304	308	313	317	322
09	273	278	282	287	291	296	300	305	309	314	318
0.10	270	274	279	283	288	292	297	301	306	310	315
11	267	271	276	280	285	289	294	298	303	307	311
12	264	268	273	277	282	286	290	295	299	304	308
13	261	265	270	274	278	283	287	291	296	300	304
14	258	262	267	271	275	279	284	288	292	297	301
15	255	259	263	268	272	276	280	285	289	293	297
16	252	256	260	265	269	273	277	281	286	290	294
17	249	253	257	261	266	270	274	278	282	286	290
18	246	250	254	258	262	266	271	275	279	283	287
19	243	247	251	255	259	263	267	271	275	279	283
0.20	240	244	248	252	256	260	264	268	272	276	280
21	237	241	245	249	253	257	261	265	269	273	276
22	234	238	242	246	250	253	257	261	265	269	273
23	231	235	239	243	246	250	254	258	262	266	269
24	228	232	236	239	243	247	251	255	258	262	266
25	225	229	232	236	240	244	247	251	255	259	262
26	222	226	229	233	237	240	244	248	252	255	259
27	219	223	226	230	234	237	241	245	248	252	255
28	216	220	223	227	230	234	238	241	245	248	252
29	213	217	220	224	227	231	234	238	241	245	248
0.30	210	213	217	220	224	227	231	234	238	241	245
31	207	210	214	217	221	224	228	231	235	238	241
32	204	207	211	214	218	221	224	228	231	235	238
33	201	204	208	211	214	218	221	224	228	231	234
34	198	201	205	208	211	214	218	221	224	228	231
35	195	198	201	205	208	211	214	218	221	224	227
36	192	195	198	202	205	208	211	214	218	221	224
37	189	192	195	198	202	205	208	211	214	217	220
38	186	189	192	195	198	201	205	208	211	214	217
39	183	186	189	192	195	198	201	204	207	210	213
0.40	180	183	186	189	192	195	198	201	204	207	210
41	177	180	183	186	189	192	195	198	201	204	206
42	174	177	180	183	186	188	191	194	197	200	203
43	171	174	177	180	182	185	188	191	194	197	199
44	168	171	174	176	179	182	185	188	190	193	196
45	165	168	170	173	176	179	181	184	187	190	192
46	162	165	167	170	173	175	178	181	184	186	189
47	159	162	164	167	170	172	175	178	180	183	185
48	156	159	161	164	166	169	172	174	177	179	182
49	153	156	158	161	163	166	168	171	173	176	178
0.50	150	152	155	157	160	162	165	167	170	172	175

Verbesserung der ersten Differenz

Phase	Zweite Differenz										
	600	610	620	630	640	650	660	670	680	690	700
0.50	150	152	155	157	160	162	165	167	170	172	175
51	147	149	152	154	157	159	162	164	167	169	171
52	144	146	149	151	154	156	158	161	163	166	168
53	141	143	146	148	150	153	155	157	160	162	164
54	138	140	143	145	147	149	152	154	156	159	161
55	135	137	139	142	144	146	148	151	153	155	157
56	132	134	136	139	141	143	145	147	150	152	154
57	129	131	133	135	138	140	142	144	146	148	150
58	126	128	130	132	134	136	139	141	143	145	147
59	123	125	127	129	131	133	135	137	139	141	143
0.60	120	122	124	126	128	130	132	134	136	138	140
61	117	119	121	123	125	127	129	131	133	135	136
62	114	116	118	120	122	123	125	127	129	131	133
63	111	113	115	117	118	120	122	124	126	128	129
64	108	110	112	113	115	117	119	121	122	124	126
65	105	107	108	110	112	114	115	117	119	121	122
66	102	104	105	107	109	110	112	114	116	117	119
67	99	101	102	104	106	107	109	111	112	114	115
68	96	98	99	101	102	104	106	107	109	110	112
69	93	95	96	98	99	101	102	104	105	107	108
0.70	90	91	93	94	96	97	99	100	102	103	105
71	87	88	90	91	93	94	96	97	99	100	101
72	84	85	87	88	90	91	92	94	95	97	98
73	81	82	84	85	86	88	89	90	92	93	94
74	78	79	81	82	83	84	86	87	88	90	91
75	75	76	77	79	80	81	82	84	85	86	87
76	72	73	74	76	77	78	79	80	82	83	84
77	69	70	71	72	74	75	76	77	78	79	80
78	66	67	68	69	70	71	73	74	75	76	77
79	63	64	65	66	67	68	69	70	71	72	73
0.80	60	61	62	63	64	65	66	67	68	69	70
81	57	58	59	60	61	62	63	64	65	66	66
82	54	55	56	57	58	58	59	60	61	62	63
83	51	52	53	54	54	55	56	57	58	59	59
84	48	49	50	50	51	52	53	54	54	55	56
85	45	46	46	47	48	49	49	50	51	52	52
86	42	43	43	44	45	45	46	47	48	48	49
87	39	40	40	41	42	42	43	44	44	45	45
88	36	37	37	38	38	39	40	40	41	41	42
89	33	34	34	35	35	36	36	37	37	38	38
0.90	30	30	31	31	32	32	33	33	34	34	35
91	27	27	28	28	29	29	30	30	31	31	31
92	24	24	25	25	26	26	26	27	27	28	28
93	21	21	22	22	22	23	23	23	24	24	24
94	18	18	19	19	19	19	20	20	20	21	21
95	15	15	15	16	16	16	16	17	17	17	17
96	12	12	12	13	13	13	13	13	14	14	14
97	9	9	9	9	10	10	10	10	10	10	10
98	6	6	6	6	6	6	7	7	7	7	7
99	3	3	3	3	3	3	3	3	3	3	3
1.00	0	0	0	0	0	0	0	0	0	0	0

Verbesserung der ersten Differenz

Phase	Zweite Differenz										
	700	710	720	730	740	750	760	770	780	790	800
0.00	350	355	360	365	370	375	380	385	390	395	400
01	346	351	356	361	366	371	376	381	386	391	396
02	343	348	353	358	363	367	372	377	382	387	392
03	339	344	349	354	359	364	369	373	378	383	388
04	336	341	346	350	355	360	365	370	374	379	384
05	332	337	342	347	351	356	361	366	370	375	380
06	329	334	338	343	348	352	357	362	367	371	376
07	325	330	335	339	344	349	353	358	363	367	372
08	322	327	331	336	340	345	350	354	359	363	308
09	318	323	328	332	337	341	346	350	355	359	304
0.10	315	319	324	328	333	337	342	346	351	355	360
11	311	316	320	325	329	334	338	343	347	352	356
12	308	312	317	321	326	330	334	339	343	348	352
13	304	309	313	318	322	326	331	335	339	344	348
14	301	305	310	314	318	322	327	331	335	340	344
15	297	302	306	310	314	319	323	327	331	336	340
16	294	298	302	307	311	315	319	323	328	332	336
17	290	295	299	303	307	311	315	320	324	328	332
18	287	291	295	299	303	307	312	316	320	324	328
19	283	288	292	296	300	304	308	312	316	320	324
0.20	280	284	288	292	296	300	304	308	312	316	320
21	276	280	284	288	292	296	300	304	308	312	316
22	273	277	281	285	289	292	296	300	304	308	312
23	269	273	277	281	285	289	293	296	300	304	308
24	266	270	274	277	281	285	289	293	296	300	304
25	262	266	270	274	277	281	285	289	292	296	300
26	259	263	266	270	274	277	281	285	289	292	296
27	255	259	263	266	270	274	277	281	285	288	292
28	252	256	259	263	266	270	274	277	281	284	288
29	248	252	256	259	263	266	270	273	277	280	284
0.30	245	248	252	255	259	262	266	269	273	276	280
31	241	245	248	252	255	259	262	266	269	273	276
32	238	241	245	248	252	255	258	262	265	269	272
33	234	238	241	245	248	251	255	258	261	265	268
34	231	234	238	241	244	247	251	254	257	261	264
35	227	231	234	237	240	244	247	250	253	257	260
36	224	227	230	234	237	240	243	246	250	253	256
37	220	224	227	230	233	236	239	243	246	249	252
38	217	220	223	226	229	232	236	239	242	245	248
39	213	217	220	223	226	229	232	235	238	241	244
0.40	210	213	216	219	222	225	228	231	234	237	240
41	206	209	212	215	218	221	224	227	230	233	236
42	203	206	209	212	215	217	220	223	226	229	232
43	199	202	205	208	211	214	217	219	222	225	228
44	196	199	202	204	207	210	213	216	218	221	224
45	192	195	198	201	203	206	209	212	214	217	220
46	189	192	194	197	200	202	205	208	211	213	216
47	185	188	191	193	196	199	201	204	207	209	212
48	182	185	187	190	192	195	198	200	203	205	208
49	178	181	184	186	189	191	194	196	199	201	204
0.50	175	177	180	182	185	187	190	192	195	197	200

Verbesserung der ersten Differenz

Phase	Zweite Differenz										
	700	710	720	730	740	750	760	770	780	790	800
0.50	175	177	180	182	185	187	190	192	195	197	200
51	171	174	176	179	181	184	186	189	191	194	196
52	168	170	173	175	178	180	182	185	187	190	192
53	164	167	169	172	174	176	179	181	183	186	188
54	161	163	166	168	170	172	175	177	179	182	184
55	157	160	162	164	166	169	171	173	175	178	180
56	154	156	158	161	163	165	167	169	172	174	176
57	150	153	155	157	159	161	163	166	168	170	172
58	147	149	151	153	155	157	160	162	164	166	168
59	143	146	148	150	152	154	156	158	160	162	164
0.60	140	142	144	146	148	150	152	154	156	158	160
61	136	138	140	142	144	146	148	150	152	154	156
62	133	135	137	139	141	142	144	146	148	150	152
63	129	131	133	135	137	139	141	142	144	146	148
64	126	128	130	131	133	135	137	139	140	142	144
65	122	124	126	128	129	131	133	135	136	138	140
66	119	121	122	124	126	127	129	131	133	134	136
67	115	117	119	120	122	124	125	127	129	130	132
68	112	114	115	117	118	120	122	123	125	126	128
69	108	110	112	113	115	116	118	119	121	122	124
0.70	105	106	108	109	111	112	114	115	117	118	120
71	101	103	104	106	107	109	110	112	113	115	116
72	98	99	101	102	104	105	106	108	109	111	112
73	94	96	97	99	100	101	103	104	105	107	108
74	91	92	94	95	96	97	99	100	101	103	104
75	87	89	90	91	92	94	95	96	97	99	100
76	84	85	86	88	89	90	91	92	94	95	96
77	80	82	83	84	85	86	87	89	90	91	92
78	77	78	79	80	81	82	84	85	86	87	88
79	73	75	76	77	78	79	80	81	82	83	84
0.80	70	71	72	73	74	75	76	77	78	79	80
81	66	67	68	69	70	71	72	73	74	75	76
82	63	64	65	66	67	67	68	69	70	71	72
83	59	60	61	62	63	64	65	65	66	67	68
84	56	57	58	58	59	60	61	62	62	63	64
85	52	53	54	55	55	56	57	58	58	59	60
86	49	50	50	51	52	52	53	54	55	55	56
87	45	46	47	47	48	49	49	50	51	51	52
88	42	43	43	44	44	45	46	46	47	47	48
89	38	39	40	40	41	41	42	42	43	43	44
0.90	35	35	36	36	37	37	38	38	39	39	40
91	31	32	32	33	33	34	34	35	35	36	36
92	28	28	29	29	30	30	30	31	31	32	32
93	24	25	25	26	26	26	27	27	27	28	28
94	21	21	22	22	22	22	23	23	23	24	24
95	17	18	18	18	18	19	19	19	19	20	20
96	14	14	14	15	15	15	15	15	16	16	16
97	10	11	11	11	11	11	11	12	12	12	12
98	7	7	7	7	7	7	8	8	8	8	8
99	3	4	4	4	4	4	4	4	4	4	4
1.00	0	0	0	0	0	0	0	0	0	0	0

Verbesserung der ersten Differenz

Phase	Zweite Differenz										
	800	810	820	830	840	850	860	870	880	890	900
0.00	400	405	410	415	420	425	430	435	440	445	450
01	396	401	406	411	416	421	426	431	436	441	445
02	392	397	402	407	412	416	421	426	431	436	441
03	388	393	398	403	407	412	417	422	427	432	436
04	384	389	394	398	403	408	413	418	422	427	432
05	380	385	389	394	399	404	408	413	418	423	427
06	376	381	385	390	395	399	404	409	414	418	423
07	372	377	381	386	391	395	400	405	409	414	418
08	368	373	377	382	386	391	396	400	405	409	414
09	364	369	373	378	382	387	391	396	400	405	409
0.10	360	364	369	373	378	382	387	391	396	400	405
11	356	360	365	369	374	378	383	387	392	396	400
12	352	356	361	365	370	374	378	383	387	392	396
13	348	352	357	361	365	370	374	378	383	387	391
14	344	348	353	357	361	365	370	374	378	383	387
15	340	344	348	353	357	361	365	370	374	378	382
16	336	340	344	349	353	357	361	365	370	374	378
17	332	336	340	344	349	353	357	361	365	369	373
18	328	332	336	340	344	348	353	357	361	365	369
19	324	328	332	336	340	344	348	352	356	360	364
0.20	320	324	328	332	336	340	344	348	352	356	360
21	316	320	324	328	332	336	340	344	348	352	355
22	312	316	320	324	328	331	335	339	343	347	351
23	308	312	316	320	323	327	331	335	339	343	346
24	304	308	312	315	319	323	327	331	334	338	342
25	300	304	307	311	315	319	322	326	330	334	337
26	296	300	303	307	311	314	318	322	326	329	333
27	292	296	299	303	307	310	314	318	321	325	328
28	288	292	295	299	302	306	310	313	317	320	324
29	284	288	291	295	298	302	305	309	312	316	319
0.30	280	283	287	290	294	297	301	304	308	311	315
31	276	279	283	286	290	293	297	300	304	307	310
32	272	275	279	282	286	289	292	296	299	303	306
33	268	271	275	278	281	285	288	291	295	298	301
34	264	267	271	274	277	280	284	287	290	294	297
35	260	263	266	270	273	276	279	283	286	289	292
36	256	259	262	266	269	272	275	278	282	285	288
37	252	255	258	261	265	268	271	274	277	280	283
38	248	251	254	257	260	263	267	270	273	276	279
39	244	247	250	253	256	259	262	265	268	271	274
0.40	240	243	246	249	252	255	258	261	264	267	270
41	236	239	242	245	248	251	254	257	260	263	265
42	232	235	238	241	244	246	249	252	255	258	261
43	228	231	234	237	239	242	245	248	251	254	256
44	224	227	230	232	235	238	241	244	246	249	252
45	220	223	225	228	231	234	236	239	242	245	247
46	216	219	221	224	227	229	232	235	238	240	243
47	212	215	217	220	223	225	228	231	233	236	238
48	208	211	213	216	218	221	224	226	229	231	234
49	204	207	209	212	214	217	219	222	224	227	229
0.50	200	202	205	207	210	212	215	217	220	222	225

Verbesserung der ersten Differenz

Phase	Zweite Differenz										
	800	810	820	830	840	850	860	870	880	890	900
0.50	200	202	205	207	210	212	215	217	220	222	225
51	196	198	201	203	206	208	211	213	216	218	220
52	192	194	197	199	202	204	206	209	211	214	216
53	188	190	193	195	197	200	202	204	207	209	211
54	184	186	189	191	193	195	198	200	202	205	207
55	180	182	184	187	189	191	193	196	198	200	202
56	176	178	180	183	185	187	189	191	194	196	198
57	172	174	176	178	181	183	185	187	189	191	193
58	168	170	172	174	176	178	181	183	185	187	189
59	164	166	168	170	172	174	176	178	180	182	184
0.60	160	162	164	166	168	170	172	174	176	178	180
61	156	158	160	162	164	166	168	170	172	174	175
62	152	154	156	158	160	161	163	165	167	169	171
63	148	150	152	154	155	157	159	161	163	165	166
64	144	146	148	149	151	153	155	157	158	160	162
65	140	142	143	145	147	149	150	152	154	156	157
66	136	138	139	141	143	144	146	148	150	151	153
67	132	134	135	137	139	140	142	144	145	147	148
68	128	130	131	133	134	136	138	139	141	142	144
69	124	126	127	129	130	132	133	135	136	138	139
0.70	120	121	123	124	126	127	129	130	132	133	135
71	116	117	119	120	122	123	125	126	128	129	130
72	112	113	115	116	118	119	120	122	123	125	126
73	108	109	111	112	113	115	116	117	119	120	121
74	104	105	107	108	109	110	112	113	114	116	117
75	100	101	102	104	105	106	107	109	110	111	112
76	96	97	98	100	101	102	103	104	106	107	108
77	92	93	94	95	97	98	99	100	101	102	103
78	88	89	90	91	92	93	95	96	97	98	99
79	84	85	86	87	88	89	90	91	92	93	94
0.80	80	81	82	83	84	85	86	87	88	89	90
81	76	77	78	79	80	81	82	83	84	85	85
82	72	73	74	75	76	76	77	78	79	80	81
83	68	69	70	71	71	72	73	74	75	76	76
84	64	65	66	66	67	68	69	70	70	71	72
85	60	61	61	62	63	64	64	65	66	67	67
86	56	57	57	58	59	59	60	61	62	62	63
87	52	53	53	54	55	55	56	57	57	58	58
88	48	49	49	50	50	51	52	52	53	53	54
89	44	45	45	46	46	47	47	48	48	49	49
0.90	40	40	41	41	42	42	43	43	44	44	45
91	36	36	37	37	38	38	39	39	40	40	40
92	32	32	33	33	34	34	34	35	35	36	36
93	28	28	29	29	29	30	30	30	31	31	31
94	24	24	25	25	25	25	26	26	26	27	27
95	20	20	20	21	21	21	21	22	22	22	22
96	16	16	16	17	17	17	17	17	18	18	18
97	12	12	12	12	13	13	13	13	13	13	13
98	8	8	8	8	8	8	9	9	9	9	9
99	4	4	4	4	4	4	4	4	4	4	4
1.00	0	0	0	0	0	0	0	0	0	0	0

Verbesserung der ersten Differenz

Phase	Zweite Differenz										
	900	910	920	930	940	950	960	970	980	990	1000
0.00	450	455	460	465	470	475	480	485	490	495	500
01	445	450	455	460	465	470	475	480	485	490	495
02	441	446	451	456	461	465	470	475	480	485	490
03	436	441	446	451	456	461	466	470	475	480	485
04	432	437	442	446	451	456	461	466	470	475	480
05	427	432	437	442	446	451	456	461	465	470	475
06	423	428	432	437	442	446	451	456	461	465	470
07	418	423	428	432	437	442	446	451	456	460	465
08	414	419	423	428	432	437	442	446	451	455	460
09	409	414	419	423	428	432	437	441	446	450	455
0.10	405	409	414	418	423	427	432	436	441	445	450
11	400	405	409	414	418	423	427	432	436	441	445
12	396	400	405	409	414	418	422	427	431	436	440
13	391	396	400	405	409	413	418	422	426	431	435
14	387	391	396	400	404	408	413	417	421	426	430
15	382	387	391	395	399	404	408	412	416	421	425
16	378	382	386	391	395	399	403	407	412	416	420
17	373	378	382	386	390	394	398	403	407	411	415
18	369	373	377	381	385	389	394	398	402	406	410
19	364	369	373	377	381	385	389	393	397	401	405
0.20	360	364	368	372	376	380	384	388	392	396	400
21	355	359	363	367	371	375	379	383	387	391	395
22	351	355	359	363	367	370	374	378	382	386	390
23	346	350	354	358	362	366	370	373	377	381	385
24	342	346	350	353	357	361	365	369	372	376	380
25	337	341	345	349	352	356	360	364	367	371	375
26	333	337	340	344	348	351	355	359	363	366	370
27	328	332	336	339	343	347	350	354	358	361	365
28	324	328	331	335	338	342	346	349	353	356	360
29	319	323	327	330	334	337	341	344	348	351	355
0.30	315	318	322	325	329	332	336	339	343	346	350
31	310	314	317	321	324	328	331	335	338	342	345
32	306	309	313	316	320	323	326	330	333	337	340
33	301	305	308	312	315	318	322	325	328	332	335
34	297	300	304	307	310	313	317	320	323	327	330
35	292	296	299	302	305	309	312	315	318	322	325
36	288	291	294	298	301	304	307	310	314	317	320
37	283	287	290	293	296	299	302	306	309	312	315
38	279	282	285	288	291	294	298	301	304	307	310
39	274	278	281	284	287	290	293	296	299	302	305
0.40	270	273	276	279	282	285	288	291	294	297	300
41	265	268	271	274	277	280	283	286	289	292	295
42	261	264	267	270	273	275	278	281	284	287	290
43	256	259	262	265	268	271	274	276	279	282	285
44	252	255	258	260	263	266	269	272	274	277	280
45	247	250	253	256	258	261	264	267	269	272	275
46	243	246	248	251	254	256	259	262	265	267	270
47	238	241	244	246	249	252	254	257	260	262	265
48	234	237	239	242	244	247	250	252	255	257	260
49	229	232	235	237	240	242	245	247	250	252	255
0.50	225	227	230	232	235	237	240	242	245	247	250

Verbesserung der ersten Differenz

Phase	Zweite Differenz										
	900	910	920	930	940	950	960	970	980	990	1000
0.50	225	227	230	232	235	237	240	242	245	247	250
51	220	223	225	228	230	233	235	238	240	243	245
52	216	218	221	223	226	228	230	233	235	238	240
53	211	214	216	219	221	223	226	228	230	233	235
54	207	209	212	214	216	218	221	223	225	228	230
55	202	205	207	209	211	214	216	218	220	223	225
56	198	200	202	205	207	209	211	213	216	218	220
57	193	196	198	200	202	204	206	209	211	213	215
58	189	191	193	195	197	199	202	204	206	208	210
59	184	187	189	191	193	195	197	199	201	203	205
0.60	180	182	184	186	188	190	192	194	196	198	200
61	175	177	179	181	183	185	187	189	191	193	195
62	171	173	175	177	179	180	182	184	186	188	190
63	166	168	170	172	174	176	178	179	181	183	185
64	162	164	166	167	169	171	173	175	176	178	180
65	157	159	161	163	164	166	168	170	171	173	175
66	153	155	156	158	160	161	163	165	167	168	170
67	148	150	152	153	155	157	158	160	162	163	165
68	144	146	147	149	150	152	154	155	157	158	160
69	139	141	143	144	146	147	149	150	152	153	155
0.70	135	136	138	139	141	142	144	145	147	148	150
71	130	132	133	135	136	138	139	141	142	144	145
72	126	127	129	130	132	133	134	136	137	139	140
73	121	123	124	126	127	128	130	131	132	134	135
74	117	118	120	121	122	123	125	126	127	129	130
75	112	114	115	116	117	119	120	121	122	124	125
76	108	109	110	112	113	114	115	116	118	119	120
77	103	105	106	107	108	109	110	112	113	114	115
78	99	100	101	102	103	104	106	107	108	109	110
79	94	96	97	98	99	100	101	102	103	104	105
0.80	90	91	92	93	94	95	96	97	98	99	100
81	85	86	87	88	89	90	91	92	93	94	95
82	81	82	83	84	85	85	86	87	88	89	90
83	76	77	78	79	80	81	82	82	83	84	85
84	72	73	74	74	75	76	77	78	78	79	80
85	67	68	69	70	70	71	72	73	73	74	75
86	63	64	64	65	66	66	67	68	69	69	70
87	58	59	60	60	61	62	62	63	64	64	65
88	54	55	55	56	56	57	58	58	59	59	60
89	49	50	51	51	52	52	53	53	54	54	55
0.90	45	45	46	46	47	47	48	48	49	49	50
91	40	41	41	42	42	43	43	44	44	45	45
92	36	36	37	37	38	38	38	39	39	40	40
93	31	32	32	33	33	33	34	34	34	35	35
94	27	27	28	28	28	28	29	29	29	30	30
95	22	23	23	23	23	24	24	24	24	25	25
96	18	18	18	19	19	19	19	19	20	20	20
97	13	14	14	14	14	14	14	15	15	15	15
98	9	9	9	9	9	9	10	10	10	10	10
99	4	5	5	5	5	5	5	5	5	5	5
1.00	0	0	0	0	0	0	0	0	0	0	0

Zehnstellige Werte für S und T

von

0.000 bis 2.100

Die Hilfsgrößen S und T dienen dazu, in dem Bereiche 0.000 bis 2.100 die zehnstelligen Logarithmen von sin und tang zu finden, sowie die umgekehrte Aufgabe zu lösen. Die Definitionsgleichungen für S und T:

$$S = \log \sin x - \log x$$
$$T = \log \operatorname{tang} x - \log x,$$

in denen x in Einheiten des Grades ausgedrückt ist, geben als Lösung der genannten Aufgaben:

1) $\log \sin x = S + \log x$ oder $\log \operatorname{tang} x = T + \log x$
2) $\log x = \log \sin x - S$ oder $\log x = \log \operatorname{tang} x - T$.

1. Beispiel.

Es sei $x = 1.993\,41252$; hierzu ist log sin zu bestimmen.
Aus der zehnstelligen Logarithmentafel findet man:

$$\log x = 0.299\,5971\,815$$

Der Seite 45 dieser Tafel entnehme man:

$$S = 8.241\,7897\,483;$$

also ist $\log \sin x = 8.541\,3869\,298$

2. Beispiel.

Es sei x aus $\log \sin x = 8.541\,3869\,298$ zu bestimmen.
Wir müssen zunächst einen genäherten Wert von x aufsuchen und entnehmen dafür der zehnstelligen Logarithmentafel

$$x = 1.993\,4126.$$

Das zugehörige S ist Seite 45 zu entnehmen:

$$S = 8.241\,7897\,483;$$

also ergibt sich $\log x = 0.299\,5971\,815$
und daraus mit Hilfe der zehnstelligen Logarithmentafel:

$$x = 1.993\,41252.$$

0°	S	d	T	d
.000	8.241 8773 676	0	8.241 8773 676	0
001	8.241 8773 676	1	8.241 8773 676	2
002	8.241 8773 675	1	8.241 8773 678	2
003	8.241 8773 674	2	8.241 8773 680	3
004	8.241 8773 672	2	8.241 8773 683	4
005	8.241 8773 670	2	8.241 8773 687	5
006	8.241 8773 668	3	8.241 8773 692	6
007	8.241 8773 665	3	8.241 8773 698	6
008	8.241 8773 662	4	8.241 8773 704	8
009	8.241 8773 658	4	8.241 8773 712	8
.010	8.241 8773 654	5	8.241 8773 720	9
011	8.241 8773 649	5	8.241 8773 729	10
012	8.241 8773 644	5	8.241 8773 739	11
013	8.241 8773 639	6	8.241 8773 750	12
014	8.241 8773 633	7	8.241 8773 762	13
015	8.241 8773 626	7	8.241 8773 775	14
016	8.241 8773 619	7	8.241 8773 789	14
017	8.241 8773 612	8	8.241 8773 803	16
018	8.241 8773 604	8	8.241 8773 819	16
019	8.241 8773 596	8	8.241 8773 835	17
.020	8.241 8773 588	9	8.241 8773 852	18
021	8.241 8773 579	10	8.241 8773 870	19
022	8.241 8773 569	10	8.241 8773 889	20
023	8.241 8773 559	10	8.241 8773 909	21
024	8.241 8773 549	11	8.241 8773 930	22
025	8.241 8773 538	11	8.241 8773 952	22
026	8.241 8773 527	12	8.241 8773 974	23
027	8.241 8773 515	12	8.241 8773 997	25
028	8.241 8773 503	13	8.241 8774 022	25
029	8.241 8773 490	13	8.241 8774 047	26
.030	8.241 8773 477	13	8.241 8774 073	27
031	8.241 8773 464	14	8.241 8774 100	27
032	8.241 8773 450	14	8.241 8774 127	29
033	8.241 8773 436	15	8.241 8774 156	30
034	8.241 8773 421	15	8.241 8774 186	30
035	8.241 8773 406	16	8.241 8774 216	31
036	8.241 8773 390	16	8.241 8774 247	33
037	8.241 8773 374	16	8.241 8774 280	33
038	8.241 8773 358	17	8.241 8774 313	34
039	8.241 8773 341	18	8.241 8774 347	34
.040	8.241 8773 323	18	8.241 8774 381	36
041	8.241 8773 305	18	8.241 8774 417	37
042	8.241 8773 287	19	8.241 8774 454	37
043	8.241 8773 268	19	8.241 8774 491	39
044	8.241 8773 249	20	8.241 8774 530	39
045	8.241 8773 229	20	8.241 8774 569	40
046	8.241 8773 209	20	8.241 8774 609	41
047	8.241 8773 189	21	8.241 8774 650	42
048	8.241 8773 168	21	8.241 8774 692	43
049	8.241 8773 147	22	8.241 8774 735	43
.050	8.241 8773 125		8.241 8774 778	
	S	d	T	d

0°	S	d	T	d
.050	8.241 8773 125	23	8.241 8774 778	45
051	8.241 8773 102	22	8.241 8774 823	45
052	8.241 8773 080	23	8.241 8774 868	47
053	8.241 8773 057	24	8.241 8774 915	47
054	8.241 8773 033	24	8.241 8774 962	48
055	8.241 8773 009	25	8.241 8775 010	49
056	8.241 8772 984	24	8.241 8775 059	50
057	8.241 8772 960	26	8.241 8775 109	50
058	8.241 8772 934	26	8.241 8775 159	52
059	8.241 8772 908	26	8.241 8775 211	52
.060	8.241 8772 882	27	8.241 8775 263	54
061	8.241 8772 855	27	8.241 8775 317	54
062	8.241 8772 828	27	8.241 8775 371	55
063	8.241 8772 801	28	8.241 8775 426	56
064	8.241 8772 773	29	8.241 8775 482	57
065	8.241 8772 744	29	8.241 8775 539	58
066	8.241 8772 715	29	8.241 8775 597	58
067	8.241 8772 686	30	8.241 8775 655	60
068	8.241 8772 656	30	8.241 8775 715	60
069	8.241 8772 626	30	8.241 8775 775	62
.070	8.241 8772 596	32	8.241 8775 837	62
071	8.241 8772 564	31	8.241 8775 899	63
072	8.241 8772 533	32	8.241 8775 962	64
073	8.241 8772 501	32	8.241 8776 026	65
074	8.241 8772 469	33	8.241 8776 091	65
075	8.241 8772 436	34	8.241 8776 156	67
076	8.241 8772 402	33	8.241 8776 223	67
077	8.241 8772 369	35	8.241 8776 290	69
078	8.241 8772 334	34	8.241 8776 359	69
079	8.241 8772 300	35	8.241 8776 428	70
.080	8.241 8772 265	36	8.241 8776 498	71
081	8.241 8772 229	36	8.241 8776 569	72
082	8.241 8772 193	36	8.241 8776 641	73
083	8.241 8772 157	37	8.241 8776 714	73
084	8.241 8772 120	37	8.241 8776 787	75
085	8.241 8772 083	38	8.241 8776 862	75
086	8.241 8772 045	38	8.241 8776 937	77
087	8.241 8772 007	39	8.241 8777 014	77
088	8.241 8771 968	39	8.241 8777 091	78
089	8.241 8771 929	39	8.241 8777 169	79
.090	8.241 8771 890	40	8.241 8777 248	80
091	8.241 8771 850	40	8.241 8777 328	80
092	8.241 8771 810	41	8.241 8777 408	82
093	8.241 8771 769	41	8.241 8777 490	82
094	8.241 8771 728	42	8.241 8777 572	84
095	8.241 8771 686	42	8.241 8777 656	84
096	8.241 8771 644	43	8.241 8777 740	85
097	8.241 8771 601	43	8.241 8777 825	86
098	8.241 8771 558	43	8.241 8777 911	87
099	8.241 8771 515	44	8.241 8777 998	88
.100	8.241 8771 471		8.241 8778 086	
	S	d	T	d

0°.100 — 0°.150

0°	S	d	T	d
.100	8.241 8771 471	44	8.241 8778 086	88
101	8.241 8771 427	45	8.241 8778 174	90
102	8.241 8771 382	45	8.241 8778 264	90
103	8.241 8771 337	46	8.241 8778 354	92
104	8.241 8771 291	46	8.241 8778 446	92
105	8.241 8771 245	47	8.241 8778 538	93
106	8.241 8771 198	46	8.241 8778 631	94
107	8.241 8771 152	48	8.241 8778 725	94
108	8.241 8771 104	48	8.241 8778 819	96
109	8.241 8771 056	48	8.241 8778 915	97
.110	8.241 8771 008	49	8.241 8779 012	97
111	8.241 8770 959	49	8.241 8779 109	99
112	8.241 8770 910	50	8.241 8779 208	99
113	8.241 8770 860	50	8.241 8779 307	100
114	8.241 8770 810	50	8.241 8779 407	101
115	8.241 8770 760	51	8.241 8779 508	102
116	8.241 8770 709	51	8.241 8779 610	102
117	8.241 8770 658	52	8.241 8779 712	104
118	8.241 8770 606	52	8.241 8779 816	105
119	8.241 8770 554	53	8.241 8779 921	105
.120	8.241 8770 501	53	8.241 8780 026	106
121	8.241 8770 448	54	8.241 8780 132	107
122	8.241 8770 394	54	8.241 8780 239	108
123	8.241 8770 340	54	8.241 8780 347	109
124	8.241 8770 286	55	8.241 8780 456	110
125	8.241 8770 231	56	8.241 8780 566	111
126	8.241 8770 175	55	8.241 8780 677	111
127	8.241 8770 120	57	8.241 8780 788	113
128	8.241 8770 063	56	8.241 8780 901	113
129	8.241 8770 007	57	8.241 8781 014	114
.130	8.241 8769 950	58	8.241 8781 128	116
131	8.241 8769 892	58	8.241 8781 244	116
132	8.241 8769 834	58	8.241 8781 360	116
133	8.241 8769 776	59	8.241 8781 476	118
134	8.241 8769 717	60	8.241 8781 594	119
135	8.241 8769 657	59	8.241 8781 713	119
136	8.241 8769 598	60	8.241 8781 832	121
137	8.241 8769 538	61	8.241 8781 953	121
138	8.241 8769 477	61	8.241 8782 074	122
139	8.241 8769 416	62	8.241 8782 196	123
.140	8.241 8769 354	62	8.241 8782 319	124
141	8.241 8769 292	62	8.241 8782 443	125
142	8.241 8769 230	63	8.241 8782 568	125
143	8.241 8769 167	63	8.241 8782 693	127
144	8.241 8769 104	64	8.241 8782 820	128
145	8.241 8769 040	64	8.241 8782 948	128
146	8.241 8768 976	65	8.241 8783 076	129
147	8.241 8768 911	65	8.241 8783 205	130
148	8.241 8768 846	65	8.241 8783 335	131
149	8.241 8768 781	66	8.241 8783 466	132
.150	8.241 8768 715		8.241 8783 598	
	S	d	T	d

0°.150 — 0°.200

0°	S	d	T	d
.150	8.241 8768 715	66	8.241 8783 598	133
151	8.241 8768 649	67	8.241 8783 731	133
152	8.241 8768 582	68	8.241 8783 864	135
153	8.241 8768 514	67	8.241 8783 999	135
154	8.241 8768 447	68	8.241 8784 134	136
155	8.241 8768 379	69	8.241 8784 270	138
156	8.241 8768 310	69	8.241 8784 408	138
157	8.241 8768 241	69	8.241 8784 546	139
158	8.241 8768 172	70	8.241 8784 685	139
159	8.241 8768 102	71	8.241 8784 824	141
.160	8.241 8768 031	70	8.241 8784 965	142
161	8.241 8767 961	72	8.241 8785 107	142
162	8.241 8767 889	71	8.241 8785 249	143
163	8.241 8767 818	72	8.241 8785 392	144
164	8.241 8767 746	73	8.241 8785 536	146
165	8.241 8767 673	73	8.241 8785 682	146
166	8.241 8767 600	73	8.241 8785 828	146
167	8.241 8767 527	74	8.241 8785 974	148
168	8.241 8767 453	74	8.241 8786 122	149
169	8.241 8767 379	75	8.241 8786 271	149
.170	8.241 8767 304	75	8.241 8786 420	151
171	8.241 8767 229	76	8.241 8786 571	151
172	8.241 8767 153	76	8.241 8786 722	152
173	8.241 8767 077	77	8.241 8786 874	153
174	8.241 8767 000	77	8.241 8787 027	154
175	8.241 8766 923	77	8.241 8787 181	155
176	8.241 8766 846	78	8.241 8787 336	155
177	8.241 8766 768	78	8.241 8787 491	157
178	8.241 8766 690	79	8.241 8787 648	157
179	8.241 8766 611	79	8.241 8787 805	159
.180	8.241 8766 532	80	8.241 8787 964	159
181	8.241 8766 452	80	8.241 8788 123	160
182	8.241 8766 372	80	8.241 8788 283	161
183	8.241 8766 292	81	8.241 8788 444	162
184	8.241 8766 211	81	8.241 8788 606	162
185	8.241 8766 130	82	8.241 8788 768	164
186	8.241 8766 048	82	8.241 8788 932	165
187	8.241 8765 966	83	8.241 8789 097	165
188	8.241 8765 883	83	8.241 8789 262	166
189	8.241 8765 800	84	8.241 8789 428	167
.190	8.241 8765 716	84	8.241 8789 595	168
191	8.241 8765 632	84	8.241 8789 763	169
192	8.241 8765 548	85	8.241 8789 932	170
193	8.241 8765 463	85	8.241 8790 102	171
194	8.241 8765 378	86	8.241 8790 273	171
195	8.241 8765 292	86	8.241 8790 444	173
196	8.241 8765 206	87	8.241 8790 617	173
197	8.241 8765 119	87	8.241 8790 790	174
198	8.241 8765 032	88	8.241 8790 964	175
199	8.241 8764 944	88	8.241 8791 139	176
.200	8.241 8764 856		8.241 8791 315	
	S	d	T	d

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.200	8.241 8764 856	88	8.241 8791 315	177
201	8.241 8764 768	89	8.241 8791 492	178
202	8.241 8764 679	89	8.241 8791 670	178
203	8.241 8764 590	90	8.241 8791 848	180
204	8.241 8764 500	90	8.241 8792 028	180
205	8.241 8764 410	91	8.241 8792 208	181
206	8.241 8764 319	91	8.241 8792 389	182
207	8.241 8764 228	91	8.241 8792 571	183
208	8.241 8764 137	92	8.241 8792 754	184
209	8.241 8764 045	93	8.241 8792 938	185
.210	8.241 8763 952	93	8.241 8793 123	186
211	8.241 8763 859	93	8.241 8793 309	186
212	8.241 8763 766	93	8.241 8793 495	188
213	8.241 8763 673	95	8.241 8793 683	188
214	8.241 8763 578	94	8.241 8793 871	189
215	8.241 8763 484	95	8.241 8794 060	190
216	8.241 8763 389	96	8.241 8794 250	191
217	8.241 8763 293	96	8.241 8794 441	192
218	8.241 8763 197	96	8.241 8794 633	193
219	8.241 8763 101	97	8.241 8794 826	193
.220	8.241 8763 004	97	8.241 8795 019	195
221	8.241 8762 907	98	8.241 8795 214	195
222	8.241 8762 809	98	8.241 8795 409	196
223	8.241 8762 711	98	8.241 8795 605	198
224	8.241 8762 613	99	8.241 8795 803	198
225	8.241 8762 514	100	8.241 8796 001	198
226	8.241 8762 414	100	8.241 8796 199	200
227	8.241 8762 314	100	8.241 8796 399	201
228	8.241 8762 214	101	8.241 8796 600	201
229	8.241 8762 113	101	8.241 8796 801	203
.230	8.241 8762 012	102	8.241 8797 004	203
231	8.241 8761 910	102	8.241 8797 207	204
232	8.241 8761 808	102	8.241 8797 411	205
233	8.241 8761 706	103	8.241 8797 616	206
234	8.241 8761 603	104	8.241 8797 822	207
235	8.241 8761 499	103	8.241 8798 029	208
236	8.241 8761 396	105	8.241 8798 237	208
237	8.241 8761 291	105	8.241 8798 445	210
238	8.241 8761 186	105	8.241 8798 655	210
239	8.241 8761 081	105	8.241 8798 865	211
.240	8.241 8760 976	106	8.241 8799 076	213
241	8.241 8760 870	107	8.241 8799 289	213
242	8.241 8760 763	107	8.241 8799 502	213
243	8.241 8760 656	107	8.241 8799 715	215
244	8.241 8760 549	108	8.241 8799 930	216
245	8.241 8760 441	108	8.241 8800 146	216
246	8.241 8760 333	109	8.241 8800 362	218
247	8.241 8760 224	109	8.241 8800 580	218
248	8.241 8760 115	110	8.241 8800 798	219
249	8.241 8760 005	110	8.241 8801 017	220
.250	8.241 8759 895		8.241 8801 237	
	S	d	T	d

0°	S	d	T	d
.250	8.241 8759 895	110	8.241 8801 237	221
251	8.241 8759 785	111	8.241 8801 458	222
252	8.241 8759 674	111	8.241 8801 680	223
253	8.241 8759 563	112	8.241 8801 903	223
254	8.241 8759 451	112	8.241 8802 126	225
255	8.241 8759 339	113	8.241 8802 351	225
256	8.241 8759 226	113	8.241 8802 576	226
257	8.241 8759 113	114	8.241 8802 802	227
258	8.241 8758 999	114	8.241 8803 029	228
259	8.241 8758 885	114	8.241 8803 257	229
.260	8.241 8758 771	115	8.241 8803 486	230
261	8.241 8758 656	115	8.241 8803 716	231
262	8.241 8758 541	116	8.241 8803 947	231
263	8.241 8758 425	116	8.241 8804 178	233
264	8.241 8758 309	117	8.241 8804 411	233
265	8.241 8758 192	117	8.241 8804 644	234
266	8.241 8758 075	118	8.241 8804 878	235
267	8.241 8757 957	118	8.241 8805 113	236
268	8.241 8757 839	118	8.241 8805 349	237
269	8.241 8757 721	119	8.241 8805 586	237
.270	8.241 8757 602	119	8.241 8805 823	239
271	8.241 8757 483	120	8.241 8806 062	239
272	8.241 8757 363	120	8.241 8806 301	241
273	8.241 8757 243	121	8.241 8806 542	241
274	8.241 8757 122	121	8.241 8806 783	242
275	8.241 8757 001	121	8.241 8807 025	243
276	8.241 8756 880	122	8.241 8807 268	244
277	8.241 8756 758	122	8.241 8807 512	245
278	8.241 8756 636	123	8.241 8807 757	245
279	8.241 8756 513	123	8.241 8808 002	247
.280	8.241 8756 390	124	8.241 8808 249	247
281	8.241 8756 266	124	8.241 8808 496	249
282	8.241 8756 142	125	8.241 8808 745	249
283	8.241 8756 017	125	8.241 8808 994	250
284	8.241 8755 892	125	8.241 8809 244	251
285	8.241 8755 767	126	8.241 8809 495	251
286	8.241 8755 641	127	8.241 8809 746	253
287	8.241 8755 514	126	8.241 8809 999	254
288	8.241 8755 388	128	8.241 8810 253	254
289	8.241 8755 260	127	8.241 8810 507	255
.290	8.241 8755 133	128	8.241 8810 762	257
291	8.241 8755 005	129	8.241 8811 019	257
292	8.241 8754 876	129	8.241 8811 276	258
293	8.241 8754 747	129	8.241 8811 534	259
294	8.241 8754 618	130	8.241 8811 793	259
295	8.241 8754 488	131	8.241 8812 052	261
296	8.241 8754 357	130	8.241 8812 313	261
297	8.241 8754 227	131	8.241 8812 574	263
298	8.241 8754 096	132	8.241 8812 837	263
299	8.241 8753 964	132	8.241 8813 100	264
.300	8.241 8753 832		8.241 8813 364	
	S	d	T	d

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.300	8.241 8753 832	133	8.241 8813 364	265
301	8.241 8753 699	133	8.241 8813 629	266
302	8.241 8753 566	133	8.241 8813 895	267
303	8.241 8753 433	134	8.241 8814 162	268
304	8.241 8753 299	134	8.241 8814 430	268
305	8.241 8753 165	135	8.241 8814 698	270
306	8.241 8753 030	135	8.241 8814 968	270
307	8.241 8752 895	136	8.241 8815 238	271
308	8.241 8752 759	136	8.241 8815 509	272
309	8.241 8752 623	136	8.241 8815 781	273
.310	8.241 8752 487	137	8.241 8816 054	274
311	8.241 8752 350	137	8.241 8816 328	275
312	8.241 8752 213	138	8.241 8816 603	275
313	8.241 8752 075	138	8.241 8816 878	277
314	8.241 8751 937	139	8.241 8817 155	277
315	8.241 8751 798	139	8.241 8817 432	279
316	8.241 8751 659	140	8.241 8817 711	279
317	8.241 8751 519	140	8.241 8817 990	280
318	8.241 8751 379	140	8.241 8818 270	281
319	8.241 8751 239	141	8.241 8818 551	281
.320	8.241 8751 098	142	8.241 8818 832	283
321	8.241 8750 956	141	8.241 8819 115	284
322	8.241 8750 815	143	8.241 8819 399	284
323	8.241 8750 672	142	8.241 8819 683	285
324	8.241 8750 530	143	8.241 8819 968	287
325	8.241 8750 387	144	8.241 8820 255	287
326	8.241 8750 243	144	8.241 8820 542	288
327	8.241 8750 099	144	8.241 8820 830	289
328	8.241 8749 955	145	8.241 8821 119	289
329	8.241 8749 810	145	8.241 8821 408	291
.330	8.241 8749 665	146	8.241 8821 699	291
331	8.241 8749 519	146	8.241 8821 990	293
332	8.241 8749 373	147	8.241 8822 283	293
333	8.241 8749 226	147	8.241 8822 576	294
334	8.241 8749 079	148	8.241 8822 870	295
335	8.241 8748 931	147	8.241 8823 165	296
336	8.241 8748 784	149	8.241 8823 461	297
337	8.241 8748 635	149	8.241 8823 758	298
338	8.241 8748 486	149	8.241 8824 056	298
339	8.241 8748 337	150	8.241 8824 354	299
.340	8.241 8748 187	150	8.241 8824 653	301
341	8.241 8748 037	150	8.241 8824 954	301
342	8.241 8747 887	151	8.241 8825 255	302
343	8.241 8747 736	152	8.241 8825 557	303
344	8.241 8747 584	152	8.241 8825 860	304
345	8.241 8747 432	152	8.241 8826 164	305
346	8.241 8747 280	153	8.241 8826 469	305
347	8.241 8747 127	153	8.241 8826 774	307
348	8.241 8746 974	154	8.241 8827 081	307
349	8.241 8746 820	154	8.241 8827 388	308
.350	8.241 8746 666		8.241 8827 696	
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.350	8.241 8746 666	155	8.241 8827 696	309
351	8.241 8746 511	155	8.241 8828 005	310
352	8.241 8746 356	155	8.241 8828 315	311
353	8.241 8746 201	156	8.241 8828 626	312
354	8.241 8746 045	156	8.241 8828 938	313
355	8.241 8745 889	157	8.241 8829 251	313
356	8.241 8745 732	157	8.241 8829 564	315
357	8.241 8745 575	158	8.241 8829 879	315
358	8.241 8745 417	158	8.241 8830 194	316
359	8.241 8745 259	159	8.241 8830 510	317
.360	8.241 8745 100	159	8.241 8830 827	318
361	8.241 8744 941	159	8.241 8831 145	319
362	8.241 8744 782	160	8.241 8831 464	320
363	8.241 8744 622	160	8.241 8831 784	320
364	8.241 8744 462	161	8.241 8832 104	322
365	8.241 8744 301	161	8.241 8832 426	322
366	8.241 8744 140	162	8.241 8832 748	323
367	8.241 8743 978	162	8.241 8833 071	325
368	8.241 8743 816	162	8.241 8833 396	325
369	8.241 8743 654	163	8.241 8833 721	326
.370	8.241 8743 491	164	8.241 8834 047	326
371	8.241 8743 327	163	8.241 8834 373	328
372	8.241 8743 164	165	8.241 8834 701	328
373	8.241 8742 999	164	8.241 8835 029	330
374	8.241 8742 835	165	8.241 8835 359	330
375	8.241 8742 670	166	8.241 8835 689	331
376	8.241 8742 504	166	8.241 8836 020	332
377	8.241 8742 338	167	8.241 8836 352	333
378	8.241 8742 171	166	8.241 8836 685	334
379	8.241 8742 005	168	8.241 8837 019	335
.380	8.241 8741 837	168	8.241 8837 354	336
381	8.241 8741 669	168	8.241 8837 690	336
382	8.241 8741 501	169	8.241 8838 026	337
383	8.241 8741 332	169	8.241 8838 363	339
384	8.241 8741 163	169	8.241 8838 702	339
385	8.241 8740 994	170	8.241 8839 041	340
386	8.241 8740 824	171	8.241 8839 381	341
387	8.241 8740 653	171	8.241 8839 722	341
388	8.241 8740 482	171	8.241 8840 063	343
389	8.241 8740 311	172	8.241 8840 406	344
.390	8.241 8740 139	172	8.241 8840 750	344
391	8.241 8739 967	172	8.241 8841 094	345
392	8.241 8739 795	174	8.241 8841 439	346
393	8.241 8739 621	173	8.241 8841 785	347
394	8.241 8739 448	174	8.241 8842 132	348
395	8.241 8739 274	174	8.241 8842 480	349
396	8.241 8739 100	175	8.241 8842 829	350
397	8.241 8738 925	176	8.241 8843 179	351
398	8.241 8738 749	175	8.241 8843 530	351
399	8.241 8738 574	176	8.241 8843 881	352
.400	8.241 8738 398		8.241 8844 233	
	S	d	T	d

0°	S	d	T	d
.400	8.241 8738 398	177	8.241 8844 233	354
401	8.241 8738 221	177	8.241 8844 587	354
402	8.241 8738 044	178	8.241 8844 941	355
403	8.241 8737 866	178	8.241 8845 296	356
404	8.241 8737 688	178	8.241 8845 652	356
405	8.241 8737 510	179	8.241 8846 008	358
406	8.241 8737 331	179	8.241 8846 366	358
407	8.241 8737 152	180	8.241 8846 724	360
408	8.241 8736 972	180	8.241 8847 084	360
409	8.241 8736 792	180	8.241 8847 444	361
.410	8.241 8736 612	181	8.241 8847 805	362
411	8.241 8736 431	182	8.241 8848 167	363
412	8.241 8736 249	182	8.241 8848 530	364
413	8.241 8736 067	182	8.241 8848 894	365
414	8.241 8735 885	183	8.241 8849 259	365
415	8.241 8735 702	183	8.241 8849 624	367
416	8.241 8735 519	184	8.241 8849 991	367
417	8.241 8735 335	184	8.241 8850 358	368
418	8.241 8735 151	185	8.241 8850 726	370
419	8.241 8734 966	185	8.241 8851 096	370
.420	8.241 8734 781	185	8.241 8851 466	370
421	8.241 8734 596	186	8.241 8851 836	372
422	8.241 8734 410	186	8.241 8852 208	373
423	8.241 8734 224	187	8.241 8852 581	373
424	8.241 8734 037	187	8.241 8852 954	375
425	8.241 8733 850	188	8.241 8853 329	375
426	8.241 8733 662	188	8.241 8853 704	376
427	8.241 8733 474	188	8.241 8854 080	377
428	8.241 8733 286	189	8.241 8854 457	378
429	8.241 8733 097	190	8.241 8854 835	379
.430	8.241 8732 907	190	8.241 8855 214	380
431	8.241 8732 717	190	8.241 8855 594	380
432	8.241 8732 527	191	8.241 8855 974	382
433	8.241 8732 336	191	8.241 8856 356	382
434	8.241 8732 145	191	8.241 8856 738	383
435	8.241 8731 954	192	8.241 8857 121	384
436	8.241 8731 762	193	8.241 8857 505	385
437	8.241 8731 569	193	8.241 8857 890	386
438	8.241 8731 376	193	8.241 8858 276	387
439	8.241 8731 183	194	8.241 8858 663	388
.440	8.241 8730 989	194	8.241 8859 051	388
441	8.241 8730 795	195	8.241 8859 439	389
442	8.241 8730 600	195	8.241 8859 828	391
443	8.241 8730 405	196	8.241 8860 219	391
444	8.241 8730 209	196	8.241 8860 610	392
445	8.241 8730 013	196	8.241 8861 002	393
446	8.241 8729 817	197	8.241 8861 395	394
447	8.241 8729 620	197	8.241 8861 789	394
448	8.241 8729 423	198	8.241 8862 183	396
449	8.241 8729 225	198	8.241 8862 579	396
.450	8.241 8729 027		8.241 8862 975	
	S	d	T	d

0°	S	d	T	d
.450	8.241 8729 027	199	8.241 8862 975	398
451	8.241 8728 828	199	8.241 8863 373	398
452	8.241 8728 629	200	8.241 8863 771	399
453	8.241 8728 429	200	8.241 8864 170	400
454	8.241 8728 229	200	8.241 8864 570	401
455	8.241 8728 029	201	8.241 8864 971	402
456	8.241 8727 828	201	8.241 8865 373	402
457	8.241 8727 627	202	8.241 8865 775	404
458	8.241 8727 425	202	8.241 8866 179	404
459	8.241 8727 223	203	8.241 8866 583	405
.460	8.241 8727 020	203	8.241 8866 988	407
461	8.241 8726 817	203	8.241 8867 395	407
462	8.241 8726 614	204	8.241 8867 802	408
463	8.241 8726 410	205	8.241 8868 210	408
464	8.241 8726 205	205	8.241 8868 618	410
465	8.241 8726 000	205	8.241 8869 028	411
466	8.241 8725 795	206	8.241 8869 439	411
467	8.241 8725 589	206	8.241 8869 850	412
468	8.241 8725 383	206	8.241 8870 262	414
469	8.241 8725 177	207	8.241 8870 676	414
.470	8.241 8724 970	208	8.241 8871 090	415
471	8.241 8724 762	208	8.241 8871 505	415
472	8.241 8724 554	208	8.241 8871 920	417
473	8.241 8724 346	209	8.241 8872 337	418
474	8.241 8724 137	209	8.241 8872 755	418
475	8.241 8723 928	210	8.241 8873 173	420
476	8.241 8723 718	210	8.241 8873 593	420
477	8.241 8723 508	211	8.241 8874 013	421
478	8.241 8723 297	211	8.241 8874 434	422
479	8.241 8723 086	211	8.241 8874 856	423
.480	8.241 8722 875	212	8.241 8875 279	424
481	8.241 8722 663	212	8.241 8875 703	425
482	8.241 8722 451	213	8.241 8876 128	425
483	8.241 8722 238	213	8.241 8876 553	427
484	8.241 8722 025	214	8.241 8876 980	427
485	8.241 8721 811	214	8.241 8877 407	428
486	8.241 8721 597	214	8.241 8877 835	429
487	8.241 8721 383	215	8.241 8878 264	430
488	8.241 8721 168	216	8.241 8878 694	431
489	8.241 8720 952	216	8.241 8879 125	432
.490	8.241 8720 736	216	8.241 8879 557	432
491	8.241 8720 520	217	8.241 8879 989	434
492	8.241 8720 303	217	8.241 8880 423	434
493	8.241 8720 086	218	8.241 8880 857	435
494	8.241 8719 868	218	8.241 8881 292	437
495	8.241 8719 650	218	8.241 8881 729	437
496	8.241 8719 432	219	8.241 8882 166	438
497	8.241 8719 213	219	8.241 8882 604	438
498	8.241 8718 994	220	8.241 8883 042	440
499	8.241 8718 774	221	8.241 8883 482	441
.500	8.241 8718 553		8.241 8883 923	
	S	d	T	d

0°	S	d	T	d
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501	8.241 8718 333	221	8.241 8884 364	442
502	8.241 8718 112	222	8.241 8884 806	444
503	8.241 8717 890	222	8.241 8885 250	444
504	8.241 8717 668	223	8.241 8885 694	445
505	8.241 8717 445	222	8.241 8886 139	445
506	8.241 8717 223	224	8.241 8886 584	447
507	8.241 8716 999	224	8.241 8887 031	448
508	8.241 8716 775	224	8.241 8887 479	448
509	8.241 8716 551	225	8.241 8887 927	450
.510	8.241 8716 326	225	8.241 8888 377	450
511	8.241 8716 101	225	8.241 8888 827	451
512	8.241 8715 876	226	8.241 8889 278	452
513	8.241 8715 650	227	8.241 8889 730	453
514	8.241 8715 423	227	8.241 8890 183	454
515	8.241 8715 196	227	8.241 8890 637	454
516	8.241 8714 969	228	8.241 8891 091	456
517	8.241 8714 741	228	8.241 8891 547	456
518	8.241 8714 513	229	8.241 8892 003	458
519	8.241 8714 284	229	8.241 8892 461	458
.520	8.241 8714 055	229	8.241 8892 919	459
521	8.241 8713 826	230	8.241 8893 378	460
522	8.241 8713 596	231	8.241 8893 838	461
523	8.241 8713 365	230	8.241 8894 299	461
524	8.241 8713 135	232	8.241 8894 760	463
525	8.241 8712 903	231	8.241 8895 223	464
526	8.241 8712 672	233	8.241 8895 687	464
527	8.241 8712 439	232	8.241 8896 151	465
528	8.241 8712 207	233	8.241 8896 616	466
529	8.241 8711 974	234	8.241 8897 082	467
.530	8.241 8711 740	234	8.241 8897 549	468
531	8.241 8711 506	234	8.241 8898 017	469
532	8.241 8711 272	235	8.241 8898 486	470
533	8.241 8711 037	235	8.241 8898 956	470
534	8.241 8710 802	236	8.241 8899 426	472
535	8.241 8710 566	236	8.241 8899 898	472
536	8.241 8710 330	237	8.241 8900 370	473
537	8.241 8710 093	237	8.241 8900 843	474
538	8.241 8709 856	237	8.241 8901 317	475
539	8.241 8709 619	238	8.241 8901 792	476
.540	8.241 8709 381	238	8.241 8902 268	477
541	8.241 8709 143	239	8.241 8902 745	477
542	8.241 8708 904	239	8.241 8903 222	479
543	8.241 8708 665	240	8.241 8903 701	479
544	8.241 8708 425	240	8.241 8904 180	480
545	8.241 8708 185	241	8.241 8904 660	482
546	8.241 8707 944	241	8.241 8905 142	482
547	8.241 8707 703	241	8.241 8905 624	482
548	8.241 8707 462	242	8.241 8906 106	484
549	8.241 8707 220	242	8.241 8906 590	485
.550	8.241 8706 978		8.241 8907 075	
	S	d	T	d

0°	S	d	T	d
.550	8.241 8706 978	243	8.241 8907 075	485
551	8.241 8706 735	243	8.241 8907 560	487
552	8.241 8706 492	244	8.241 8908 047	487
553	8.241 8706 248	244	8.241 8908 534	488
554	8.241 8706 004	245	8.241 8909 022	489
555	8.241 8705 759	245	8.241 8909 511	490
556	8.241 8705 514	245	8.241 8910 001	491
557	8.241 8705 269	246	8.241 8910 492	492
558	8.241 8705 023	246	8.241 8910 984	492
559	8.241 8704 777	247	8.241 8911 476	494
.560	8.241 8704 530	247	8.241 8911 970	494
561	8.241 8704 283	248	8.241 8912 464	496
562	8.241 8704 035	248	8.241 8912 960	496
563	8.241 8703 787	248	8.241 8913 456	497
564	8.241 8703 539	249	8.241 8913 953	498
565	8.241 8703 290	249	8.241 8914 451	498
566	8.241 8703 041	250	8.241 8914 949	500
567	8.241 8702 791	251	8.241 8915 449	501
568	8.241 8702 540	250	8.241 8915 950	501
569	8.241 8702 290	251	8.241 8916 451	502
.570	8.241 8702 039	252	8.241 8916 953	503
571	8.241 8701 787	252	8.241 8917 456	504
572	8.241 8701 535	252	8.241 8917 960	505
573	8.241 8701 283	253	8.241 8918 465	506
574	8.241 8701 030	254	8.241 8918 971	507
575	8.241 8700 776	253	8.241 8919 478	508
576	8.241 8700 523	255	8.241 8919 986	508
577	8.241 8700 268	254	8.241 8920 494	509
578	8.241 8700 014	255	8.241 8921 003	511
579	8.241 8699 759	256	8.241 8921 514	511
.580	8.241 8699 503	256	8.241 8922 025	512
581	8.241 8699 247	256	8.241 8922 537	513
582	8.241 8698 991	257	8.241 8923 050	513
583	8.241 8698 734	258	8.241 8923 563	515
584	8.241 8698 476	257	8.241 8924 078	516
585	8.241 8698 219	259	8.241 8924 594	516
586	8.241 8697 960	258	8.241 8925 110	517
587	8.241 8697 702	259	8.241 8925 627	518
588	8.241 8697 443	260	8.241 8926 145	520
589	8.241 8697 183	260	8.241 8926 665	519
.590	8.241 8696 923	260	8.241 8927 184	521
591	8.241 8696 663	261	8.241 8927 705	522
592	8.241 8696 402	261	8.241 8928 227	523
593	8.241 8696 141	262	8.241 8928 750	523
594	8.241 8695 879	262	8.241 8929 273	524
595	8.241 8695 617	263	8.241 8929 797	526
596	8.241 8695 354	263	8.241 8930 323	526
597	8.241 8695 091	263	8.241 8930 849	527
598	8.241 8694 828	264	8.241 8931 376	528
599	8.241 8694 564	265	8.241 8931 904	528
.600	8.241 8694 299		8.241 8932 432	
	S	d	T	d

0°	S	d	T	d
.600	8.241 8694 299	264	8.241 8932 432	530
601	8.241 8694 035	266	8.241 8932 962	531
602	8.241 8693 769	265	8.241 8933 493	531
603	8.241 8693 504	266	8.241 8934 024	532
604	8.241 8693 238	267	8.241 8934 556	533
605	8.241 8692 971	267	8.241 8935 089	534
606	8.241 8692 704	268	8.241 8935 623	535
607	8.241 8692 436	267	8.241 8936 158	536
608	8.241 8692 169	269	8.241 8936 694	537
609	8.241 8691 900	269	8.241 8937 231	537
.610	8.241 8691 631	269	8.241 8937 768	539
611	8.241 8691 362	269	8.241 8938 307	539
612	8.241 8691 093	271	8.241 8938 846	541
613	8.241 8690 822	270	8.241 8939 387	541
614	8.241 8690 552	271	8.241 8939 928	542
615	8.241 8690 281	271	8.241 8940 470	543
616	8.241 8690 010	272	8.241 8941 013	543
617	8.241 8689 738	273	8.241 8941 556	545
618	8.241 8689 465	272	8.241 8942 101	545
619	8.241 8689 193	274	8.241 8942 646	547
.620	8.241 8688 919	273	8.241 8943 193	547
621	8.241 8688 646	274	8.241 8943 740	548
622	8.241 8688 372	275	8.241 8944 288	549
623	8.241 8688 097	275	8.241 8944 837	550
624	8.241 8687 822	275	8.241 8945 387	551
625	8.241 8687 547	276	8.241 8945 938	552
626	8.241 8687 271	276	8.241 8946 490	552
627	8.241 8686 995	277	8.241 8947 042	554
628	8.241 8686 718	277	8.241 8947 596	554
629	8.241 8686 441	278	8.241 8948 150	555
.630	8.241 8686 163	278	8.241 8948 705	556
631	8.241 8685 885	278	8.241 8949 261	557
632	8.241 8685 607	279	8.241 8949 818	558
633	8.241 8685 328	280	8.241 8950 376	559
634	8.241 8685 048	279	8.241 8950 935	560
635	8.241 8684 769	281	8.241 8951 495	560
636	8.241 8684 488	280	8.241 8952 055	562
637	8.241 8684 208	281	8.241 8952 617	562
638	8.241 8683 927	282	8.241 8953 179	563
639	8.241 8683 645	282	8.241 8953 742	564
.640	8.241 8683 363	282	8.241 8954 306	565
641	8.241 8683 081	283	8.241 8954 871	566
642	8.241 8682 798	284	8.241 8955 437	567
643	8.241 8682 514	283	8.241 8956 004	567
644	8.241 8682 231	285	8.241 8956 571	569
645	8.241 8681 946	284	8.241 8957 140	569
646	8.241 8681 662	285	8.241 8957 709	570
647	8.241 8681 377	286	8.241 8958 279	571
648	8.241 8681 091	286	8.241 8958 850	572
649	8.241 8680 805	286	8.241 8959 422	573
.650	8.241 8680 519		8.241 8959 995	
	S	d	T	d

0°	S	d	T	d
.650	8.241 8680 519	287	8.241 8959 995	574
651	8.241 8680 232	287	8.241 8960 569	574
652	8.241 8679 945	288	8.241 8961 143	576
653	8.241 8679 657	288	8.241 8961 719	576
654	8.241 8679 369	289	8.241 8962 295	578
655	8.241 8679 080	289	8.241 8962 873	578
656	8.241 8678 791	290	8.241 8963 451	579
657	8.241 8678 501	290	8.241 8964 030	580
658	8.241 8678 211	290	8.241 8964 610	581
659	8.241 8677 921	291	8.241 8965 191	581
.660	8.241 8677 630	291	8.241 8965 772	583
661	8.241 8677 339	292	8.241 8966 355	583
662	8.241 8677 047	292	8.241 8966 938	585
663	8.241 8676 755	292	8.241 8967 523	585
664	8.241 8676 463	293	8.241 8968 108	586
665	8.241 8676 170	294	8.241 8968 694	587
666	8.241 8675 876	294	8.241 8969 281	588
667	8.241 8675 582	294	8.241 8969 869	589
668	8.241 8675 288	295	8.241 8970 458	589
669	8.241 8674 993	295	8.241 8971 047	591
.670	8.241 8674 698	296	8.241 8971 638	591
671	8.241 8674 402	296	8.241 8972 229	592
672	8.241 8674 106	297	8.241 8972 821	593
673	8.241 8673 809	297	8.241 8973 414	594
674	8.241 8673 512	297	8.241 8974 008	595
675	8.241 8673 215	298	8.241 8974 603	596
676	8.241 8672 917	298	8.241 8975 199	597
677	8.241 8672 619	299	8.241 8975 796	597
678	8.241 8672 320	299	8.241 8976 393	599
679	8.241 8672 021	300	8.241 8976 992	599
.680	8.241 8671 721	300	8.241 8977 591	600
681	8.241 8671 421	301	8.241 8978 191	602
682	8.241 8671 120	300	8.241 8978 793	602
683	8.241 8670 820	302	8.241 8979 395	602
684	8.241 8670 518	302	8.241 8979 997	604
685	8.241 8670 216	302	8.241 8980 601	605
686	8.241 8669 914	303	8.241 8981 206	605
687	8.241 8669 611	303	8.241 8981 811	607
688	8.241 8669 308	304	8.241 8982 418	607
689	8.241 8669 004	304	8.241 8983 025	608
.690	8.241 8668 700	304	8.241 8983 633	609
691	8.241 8668 396	305	8.241 8984 242	610
692	8.241 8668 091	305	8.241 8984 852	611
693	8.241 8667 786	306	8.241 8985 463	611
694	8.241 8667 480	307	8.241 8986 074	613
695	8.241 8667 173	306	8.241 8986 687	613
696	8.241 8666 867	307	8.241 8987 300	615
697	8.241 8666 560	308	8.241 8987 915	615
698	8.241 8666 252	308	8.241 8988 530	616
699	8.241 8665 944	308	8.241 8989 146	617
.700	8.241 8665 636		8.241 8989 763	
	S	d	T	d

0°	S	d	T	d
.700	8.241 8665 636	309	8.241 8989 763	618
701	8.241 8665 327	310	8.241 8990 381	619
702	8.241 8665 017	310	8.241 8991 000	619
703	8.241 8664 707	310	8.241 8991 619	621
704	8.241 8664 397	310	8.241 8992 240	621
705	8.241 8664 087	312	8.241 8992 861	622
706	8.241 8663 775	311	8.241 8993 483	624
707	8.241 8663 464	312	8.241 8994 107	624
708	8.241 8663 152	313	8.241 8994 731	625
709	8.241 8662 839	312	8.241 8995 356	625
.710	8.241 8662 527	314	8.241 8995 981	627
711	8.241 8662 213	313	8.241 8996 608	628
712	8.241 8661 900	315	8.241 8997 236	628
713	8.241 8661 585	314	8.241 8997 864	629
714	8.241 8661 271	315	8.241 8998 493	631
715	8.241 8660 956	316	8.241 8999 124	631
716	8.241 8660 640	316	8.241 8999 755	632
717	8.241 8660 324	316	8.241 9000 387	632
718	8.241 8660 008	317	8.241 9001 019	634
719	8.241 8659 691	317	8.241 9001 653	635
.720	8.241 8659 374	318	8.241 9002 288	635
721	8.241 8659 056	318	8.241 9002 923	637
722	8.241 8658 738	319	8.241 9003 560	637
723	8.241 8658 419	319	8.241 9004 197	638
724	8.241 8658 100	319	8.241 9004 835	639
725	8.241 8657 781	320	8.241 9005 474	640
726	8.241 8657 461	321	8.241 9006 114	641
727	8.241 8657 140	321	8.241 9006 755	641
728	8.241 8656 819	321	8.241 9007 396	643
729	8.241 8656 498	322	8.241 9008 039	643
.730	8.241 8656 176	322	8.241 9008 682	645
731	8.241 8655 854	322	8.241 9009 327	645
732	8.241 8655 532	323	8.241 9009 972	646
733	8.241 8655 209	324	8.241 9010 618	647
734	8.241 8654 885	324	8.241 9011 265	648
735	8.241 8654 561	324	8.241 9011 913	649
736	8.241 8654 237	325	8.241 9012 562	649
737	8.241 8653 912	325	8.241 9013 211	651
738	8.241 8653 587	326	8.241 9013 862	651
739	8.241 8653 261	326	8.241 9014 513	652
.740	8.241 8652 935	326	8.241 9015 165	653
741	8.241 8652 609	327	8.241 9015 818	654
742	8.241 8652 282	328	8.241 9016 472	655
743	8.241 8651 954	328	8.241 9017 127	656
744	8.241 8651 626	328	8.241 9017 783	657
745	8.241 8651 298	329	8.241 9018 440	657
746	8.241 8650 969	329	8.241 9019 097	659
747	8.241 8650 640	330	8.241 9019 756	659
748	8.241 8650 310	330	8.241 9020 415	660
749	8.241 8649 980	330	8.241 9021 075	661
.750	8.241 8649 650		8.241 9021 736	
	S	d	T	d

0°	S	d	T	d
.750	8.241 8649 650	331	8.241 9021 736	662
751	8.241 8649 319	331	8.241 9022 398	663
752	8.241 8648 988	332	8.241 9023 061	664
753	8.241 8648 656	333	8.241 9023 725	665
754	8.241 8648 323	332	8.241 9024 390	665
755	8.241 8647 991	333	8.241 9025 055	666
756	8.241 8647 658	334	8.241 9025 721	668
757	8.241 8647 324	334	8.241 9026 389	668
758	8.241 8646 990	335	8.241 9027 057	669
759	8.241 8646 655	335	8.241 9027 726	670
.760	8.241 8646 320	335	8.241 9028 396	671
761	8.241 8645 985	336	8.241 9029 067	671
762	8.241 8645 649	336	8.241 9029 738	673
763	8.241 8645 313	337	8.241 9030 411	673
764	8.241 8644 976	337	8.241 9031 084	675
765	8.241 8644 639	337	8.241 9031 759	675
766	8.241 8644 302	338	8.241 9032 434	676
767	8.241 8643 964	339	8.241 9033 110	677
768	8.241 8643 625	339	8.241 9033 787	678
769	8.241 8643 286	339	8.241 9034 465	678
.770	8.241 8642 947	340	8.241 9035 143	680
771	8.241 8642 607	340	8.241 9035 823	680
772	8.241 8642 267	341	8.241 9036 503	682
773	8.241 8641 926	341	8.241 9037 185	682
774	8.241 8641 585	341	8.241 9037 867	683
775	8.241 8641 244	342	8.241 9038 550	684
776	8.241 8640 902	343	8.241 9039 234	685
777	8.241 8640 559	343	8.241 9039 919	686
778	8.241 8640 216	343	8.241 9040 605	687
779	8.241 8639 873	344	8.241 9041 292	687
.780	8.241 8639 529	344	8.241 9041 979	688
781	8.241 8639 185	345	8.241 9042 667	690
782	8.241 8638 840	345	8.241 9043 357	690
783	8.241 8638 495	345	8.241 9044 047	691
784	8.241 8638 150	346	8.241 9044 738	692
785	8.241 8637 804	346	8.241 9045 430	693
786	8.241 8637 458	347	8.241 9046 123	694
787	8.241 8637 111	348	8.241 9046 817	694
788	8.241 8636 763	347	8.241 9047 511	696
789	8.241 8636 416	348	8.241 9048 207	696
.790	8.241 8636 068	349	8.241 9048 903	697
791	8.241 8635 719	349	8.241 9049 600	698
792	8.241 8635 370	350	8.241 9050 298	699
793	8.241 8635 020	349	8.241 9050 997	700
794	8.241 8634 671	351	8.241 9051 697	701
795	8.241 8634 320	351	8.241 9052 398	702
796	8.241 8633 969	351	8.241 9053 100	702
797	8.241 8633 618	352	8.241 9053 802	704
798	8.241 8633 266	352	8.241 9054 506	704
799	8.241 8632 914	352	8.241 9055 210	705
.800	8.241 8632 562		8.241 9055 915	
	S	d	T	d

0°	S	d	T	d
.800	8.241 8632 562	353	8.241 9055 915	706
801	8.241 8632 209	354	8.241 9056 621	707
802	8.241 8631 855	354	8.241 9057 328	708
803	8.241 8631 501	354	8.241 9058 036	709
804	8.241 8631 147	355	8.241 9058 745	709
805	8.241 8630 792	355	8.241 9059 454	711
806	8.241 8630 437	356	8.241 9060 165	711
807	8.241 8630 081	356	8.241 9060 876	713
808	8.241 8629 725	356	8.241 9061 589	713
809	8.241 8629 369	357	8.241 9062 302	714
.810	8.241 8629 012	358	8.241 9063 016	715
811	8.241 8628 654	357	8.241 9063 731	715
812	8.241 8628 297	359	8.241 9064 446	717
813	8.241 8627 938	358	8.241 9065 163	718
814	8.241 8627 580	360	8.241 9065 881	718
815	8.241 8627 220	359	8.241 9066 599	719
816	8.241 8626 861	360	8.241 9067 318	720
817	8.241 8626 501	361	8.241 9068 038	721
818	8.241 8626 140	361	8.241 9068 759	722
819	8.241 8625 779	361	8.241 9069 481	723
.820	8.241 8625 418	362	8.241 9070 204	724
821	8.241 8625 056	362	8.241 9070 928	725
822	8.241 8624 694	363	8.241 9071 653	725
823	8.241 8624 331	363	8.241 9072 378	726
824	8.241 8623 968	364	8.241 9073 104	728
825	8.241 8623 604	364	8.241 9073 832	728
826	8.241 8623 240	364	8.241 9074 560	729
827	8.241 8622 876	365	8.241 9075 289	730
828	8.241 8622 511	366	8.241 9076 019	730
829	8.241 8622 145	365	8.241 9076 749	732
.830	8.241 8621 780	367	8.241 9077 481	733
831	8.241 8621 413	366	8.241 9078 214	733
832	8.241 8621 047	367	8.241 9078 947	734
833	8.241 8620 680	368	8.241 9079 681	736
834	8.241 8620 312	368	8.241 9080 417	736
835	8.241 8619 944	368	8.241 9081 153	737
836	8.241 8619 576	369	8.241 9081 890	737
837	8.241 8619 207	370	8.241 9082 627	739
838	8.241 8618 837	369	8.241 9083 366	740
839	8.241 8618 468	371	8.241 9084 106	740
.840	8.241 8618 097	370	8.241 9084 846	742
841	8.241 8617 727	371	8.241 9085 588	742
842	8.241 8617 356	372	8.241 9086 330	743
843	8.241 8616 984	372	8.241 9087 073	744
844	8.241 8616 612	372	8.241 9087 817	745
845	8.241 8616 240	373	8.241 9088 562	746
846	8.241 8615 867	373	8.241 9089 308	746
847	8.241 8615 494	374	8.241 9090 054	748
848	8.241 8615 120	374	8.241 9090 802	748
849	8.241 8614 746	375	8.241 9091 550	750
.850	8.241 8614 371		8.241 9092 300	
	S	d	T	d

0°	S	d	T	d
.850	8.241 8614 371	375	8.241 9092 300	750
851	8.241 8613 996	375	8.241 9093 050	751
852	8.241 8613 621	376	8.241 9093 801	752
853	8.241 8613 245	377	8.241 9094 553	753
854	8.241 8612 868	377	8.241 9095 306	753
855	8.241 8612 491	377	8.241 9096 059	755
856	8.241 8612 114	378	8.241 9096 814	755
857	8.241 8611 736	378	8.241 9097 569	757
858	8.241 8611 358	378	8.241 9098 326	757
859	8.241 8610 980	379	8.241 9099 083	758
.860	8.241 8610 601	380	8.241 9099 841	759
861	8.241 8610 221	380	8.241 9100 600	760
862	8.241 8609 841	380	8.241 9101 360	761
863	8.241 8609 461	381	8.241 9102 121	761
864	8.241 8609 080	381	8.241 9102 882	763
865	8.241 8608 699	382	8.241 9103 645	763
866	8.241 8608 317	382	8.241 9104 408	765
867	8.241 8607 935	382	8.241 9105 173	765
868	8.241 8607 553	383	8.241 9105 938	766
869	8.241 8607 170	384	8.241 9106 704	767
.870	8.241 8606 786	384	8.241 9107 471	768
871	8.241 8606 402	384	8.241 9108 239	768
872	8.241 8606 018	385	8.241 9109 007	770
873	8.241 8605 633	385	8.241 9109 777	770
874	8.241 8605 248	386	8.241 9110 547	772
875	8.241 8604 862	386	8.241 9111 319	772
876	8.241 8604 476	386	8.241 9112 091	773
877	8.241 8604 090	387	8.241 9112 864	774
878	8.241 8603 703	388	8.241 9113 638	775
879	8.241 8603 315	387	8.241 9114 413	776
.880	8.241 8602 928	389	8.241 9115 189	776
881	8.241 8602 539	388	8.241 9115 965	778
882	8.241 8602 151	390	8.241 9116 743	778
883	8.241 8601 761	389	8.241 9117 521	780
884	8.241 8601 372	390	8.241 9118 301	780
885	8.241 8600 982	391	8.241 9119 081	781
886	8.241 8600 591	391	8.241 9119 862	782
887	8.241 8600 200	391	8.241 9120 644	783
888	8.241 8599 809	392	8.241 9121 427	783
889	8.241 8599 417	392	8.241 9122 210	785
.890	8.241 8599 025	393	8.241 9122 995	785
891	8.241 8598 632	393	8.241 9123 780	787
892	8.241 8598 239	394	8.241 9124 567	787
893	8.241 8597 845	394	8.241 9125 354	788
894	8.241 8597 451	394	8.241 9126 142	789
895	8.241 8597 057	395	8.241 9126 931	790
896	8.241 8596 662	395	8.241 9127 721	791
897	8.241 8596 267	396	8.241 9128 512	791
898	8.241 8595 871	396	8.241 9129 303	793
899	8.241 8595 475	397	8.241 9130 096	793
.900	8.241 8595 078		8.241 9130 889	
	S	d	T	d

0°.900 — 0°.950

0°	S	d	T	d
.900	8.241 8595 078	397	8.241 9130 889	795
901	8.241 8594 681	398	8.241 9131 684	795
902	8.241 8594 283	398	8.241 9132 479	796
903	8.241 8593 885	398	8.241 9133 275	797
904	8.241 8593 487	399	8.241 9134 072	798
905	8.241 8593 088	399	8.241 9134 870	798
906	8.241 8592 689	400	8.241 9135 668	800
907	8.241 8592 289	400	8.241 9136 468	800
908	8.241 8591 889	401	8.241 9137 268	802
909	8.241 8591 488	401	8.241 9138 070	802
.910	8.241 8591 087	401	8.241 9138 872	803
911	8.241 8590 686	402	8.241 9139 675	804
912	8.241 8590 284	403	8.241 9140 479	805
913	8.241 8589 881	403	8.241 9141 284	806
914	8.241 8589 478	403	8.241 9142 090	806
915	8.241 8589 075	404	8.241 9142 896	808
916	8.241 8588 671	404	8.241 9143 704	808
917	8.241 8588 267	404	8.241 9144 512	810
918	8.241 8587 863	405	8.241 9145 322	810
919	8.241 8587 458	406	8.241 9146 132	811
.920	8.241 8587 052	406	8.241 9146 943	812
921	8.241 8586 646	406	8.241 9147 755	813
922	8.241 8586 240	407	8.241 9148 568	813
923	8.241 8585 833	407	8.241 9149 381	815
924	8.241 8585 426	408	8.241 9150 196	815
925	8.241 8585 018	408	8.241 9151 011	817
926	8.241 8584 610	409	8.241 9151 828	817
927	8.241 8584 201	409	8.241 9152 645	818
928	8.241 8583 792	409	8.241 9153 463	819
929	8.241 8583 383	410	8.241 9154 282	820
.930	8.241 8582 973	410	8.241 9155 102	821
931	8.241 8582 563	411	8.241 9155 923	821
932	8.241 8582 152	411	8.241 9156 744	823
933	8.241 8581 741	412	8.241 9157 567	823
934	8.241 8581 329	412	8.241 9158 390	825
935	8.241 8580 917	413	8.241 9159 215	825
936	8.241 8580 504	413	8.241 9160 040	826
937	8.241 8580 091	413	8.241 9160 866	827
938	8.241 8579 678	414	8.241 9161 693	828
939	8.241 8579 264	414	8.241 9162 521	828
.940	8.241 8578 850	415	8.241 9163 349	830
941	8.241 8578 435	415	8.241 9164 179	830
942	8.241 8578 020	416	8.241 9165 009	832
943	8.241 8577 604	416	8.241 9165 841	832
944	8.241 8577 188	416	8.241 9166 673	833
945	8.241 8576 772	417	8.241 9167 506	834
946	8.241 8576 355	418	8.241 9168 340	835
947	8.241 8575 937	418	8.241 9169 175	836
948	8.241 8575 519	418	8.241 9170 011	836
949	8.241 8575 101	419	8.241 9170 847	838
.950	8.241 8574 682		8.241 9171 685	
	S	d	T	d

0°.950 — 1°.000

0°	S	d	T	d
.950	8.241 8574 682	419	8.241 9171 685	838
951	8.241 8574 263	419	8.241 9172 523	840
952	8.241 8573 844	420	8.241 9173 363	840
953	8.241 8573 424	421	8.241 9174 203	841
954	8.241 8573 003	421	8.241 9175 044	842
955	8.241 8572 582	421	8.241 9175 886	843
956	8.241 8572 161	422	8.241 9176 729	843
957	8.241 8571 739	422	8.241 9177 572	845
958	8.241 8571 317	423	8.241 9178 417	845
959	8.241 8570 894	423	8.241 9179 262	847
.960	8.241 8570 471	424	8.241 9180 109	847
961	8.241 8570 047	424	8.241 9180 956	848
962	8.241 8569 623	424	8.241 9181 804	849
963	8.241 8569 199	425	8.241 9182 653	850
964	8.241 8568 774	425	8.241 9183 503	851
965	8.241 8568 349	426	8.241 9184 354	851
966	8.241 8567 923	426	8.241 9185 205	853
967	8.241 8567 497	427	8.241 9186 058	853
968	8.241 8567 070	427	8.241 9186 911	855
969	8.241 8566 643	428	8.241 9187 766	855
.970	8.241 8566 215	428	8.241 9188 621	856
971	8.241 8565 787	428	8.241 9189 477	857
972	8.241 8565 359	429	8.241 9190 334	857
973	8.241 8564 930	429	8.241 9191 191	859
974	8.241 8564 501	430	8.241 9192 050	860
975	8.241 8564 071	430	8.241 9192 910	860
976	8.241 8563 641	431	8.241 9193 770	862
977	8.241 8563 210	431	8.241 9194 632	862
978	8.241 8562 779	431	8.241 9195 494	863
979	8.241 8562 348	432	8.241 9196 357	864
.980	8.241 8561 916	433	8.241 9197 221	865
981	8.241 8561 483	432	8.241 9198 086	866
982	8.241 8561 051	434	8.241 9198 952	866
983	8.241 8560 617	433	8.241 9199 818	868
984	8.241 8560 184	435	8.241 9200 686	868
985	8.241 8559 749	434	8.241 9201 554	869
986	8.241 8559 315	435	8.241 9202 423	871
987	8.241 8558 880	436	8.241 9203 294	871
988	8.241 8558 444	436	8.241 9204 165	872
989	8.241 8558 008	436	8.241 9205 037	872
.990	8.241 8557 572	437	8.241 9205 909	874
991	8.241 8557 135	437	8.241 9206 783	875
992	8.241 8556 698	438	8.241 9207 658	875
993	8.241 8556 260	438	8.241 9208 533	877
994	8.241 8555 822	438	8.241 9209 410	877
995	8.241 8555 384	439	8.241 9210 287	878
996	8.241 8554 945	440	8.241 9211 165	879
997	8.241 8554 505	440	8.241 9212 044	880
998	8.241 8554 065	440	8.241 9212 924	880
999	8.241 8553 625	441	8.241 9213 804	882
*.000	8.241 8553 184		8.241 9214 686	
	S	d	T	d

1°	S	d	T	d
.000	8.241 8553 184	441	8.241 9214 686	883
001	8.241 8552 743	442	8.241 9215 569	883
002	8.241 8552 301	442	8.241 9216 452	884
003	8.241 8551 859	442	8.241 9217 336	886
004	8.241 8551 417	443	8.241 9218 222	886
005	8.241 8550 974	444	8.241 9219 108	887
006	8.241 8550 530	443	8.241 9219 995	887
007	8.241 8550 087	445	8.241 9220 882	889
008	8.241 8549 642	445	8.241 9221 771	890
009	8.241 8549 197	445	8.241 9222 661	890
.010	8.241 8548 752	445	8.241 9223 551	891
011	8.241 8548 307	446	8.241 9224 442	893
012	8.241 8547 861	447	8.241 9225 335	893
013	8.241 8547 414	447	8.241 9226 228	894
014	8.241 8546 967	447	8.241 9227 122	895
015	8.241 8546 520	448	8.241 9228 017	895
016	8.241 8546 072	448	8.241 9228 912	897
017	8.241 8545 624	449	8.241 9229 809	898
018	8.241 8545 175	449	8.241 9230 707	898
019	8.241 8544 726	450	8.241 9231 605	899
.020	8.241 8544 276	450	8.241 9232 504	900
021	8.241 8543 826	450	8.241 9233 404	901
022	8.241 8543 376	451	8.241 9234 305	902
023	8.241 8542 925	451	8.241 9235 207	903
024	8.241 8542 474	452	8.241 9236 110	904
025	8.241 8542 022	453	8.241 9237 014	905
026	8.241 8541 569	452	8.241 9237 919	905
027	8.241 8541 117	453	8.241 9238 824	906
028	8.241 8540 664	454	8.241 9239 730	908
029	8.241 8540 210	454	8.241 9240 638	908
.030	8.241 8539 756	454	8.241 9241 546	909
031	8.241 8539 302	455	8.241 9242 455	910
032	8.241 8538 847	455	8.241 9243 365	910
033	8.241 8538 392	456	8.241 9244 275	912
034	8.241 8537 936	456	8.241 9245 187	912
035	8.241 8537 480	457	8.241 9246 099	914
036	8.241 8537 023	457	8.241 9247 013	914
037	8.241 8536 566	458	8.241 9247 927	915
038	8.241 8536 108	458	8.241 9248 842	916
039	8.241 8535 650	458	8.241 9249 758	917
.040	8.241 8535 192	459	8.241 9250 675	918
041	8.241 8534 733	459	8.241 9251 593	919
042	8.241 8534 274	460	8.241 9252 512	919
043	8.241 8533 814	460	8.241 9253 431	921
044	8.241 8533 354	461	8.241 9254 352	921
045	8.241 8532 893	461	8.241 9255 273	922
046	8.241 8532 432	461	8.241 9256 195	924
047	8.241 8531 971	462	8.241 9257 119	924
048	8.241 8531 509	463	8.241 9258 043	924
049	8.241 8531 046	462	8.241 9258 967	926
.050	8.241 8530 584		8.241 9259 893	
	S	d	T	d

1°	S	d	T	d
.050	8.241 8530 584	464	8.241 9259 893	927
051	8.241 8530 120	463	8.241 9260 820	927
052	8.241 8529 657	465	8.241 9261 747	929
053	8.241 8529 192	464	8.241 9262 676	929
054	8.241 8528 728	465	8.241 9263 605	930
055	8.241 8528 263	466	8.241 9264 535	931
056	8.241 8527 797	465	8.241 9265 466	932
057	8.241 8527 332	467	8.241 9266 398	933
058	8.241 8526 865	467	8.241 9267 331	934
059	8.241 8526 398	467	8.241 9268 265	934
.060	8.241 8525 931	468	8.241 9269 199	936
061	8.241 8525 463	468	8.241 9270 135	936
062	8.241 8524 995	468	8.241 9271 071	937
063	8.241 8524 527	469	8.241 9272 008	939
064	8.241 8524 058	470	8.241 9272 947	939
065	8.241 8523 588	469	8.241 9273 886	939
066	8.241 8523 119	471	8.241 9274 825	941
067	8.241 8522 648	471	8.241 9275 766	942
068	8.241 8522 177	471	8.241 9276 708	942
069	8.241 8521 706	471	8.241 9277 650	944
.070	8.241 8521 235	472	8.241 9278 594	944
071	8.241 8520 763	473	8.241 9279 538	945
072	8.241 8520 290	473	8.241 9280 483	946
073	8.241 8519 817	473	8.241 9281 429	947
074	8.241 8519 344	474	8.241 9282 376	948
075	8.241 8518 870	474	8.241 9283 324	949
076	8.241 8518 396	475	8.241 9284 273	949
077	8.241 8517 921	475	8.241 9285 222	951
078	8.241 8517 446	476	8.241 9286 173	951
079	8.241 8516 970	476	8.241 9287 124	952
.080	8.241 8516 494	477	8.241 9288 076	953
081	8.241 8516 017	476	8.241 9289 029	954
082	8.241 8515 541	478	8.241 9289 983	955
083	8.241 8515 063	478	8.241 9290 938	956
084	8.241 8514 585	478	8.241 9291 894	957
085	8.241 8514 107	479	8.241 9292 851	957
086	8.241 8513 628	479	8.241 9293 808	959
087	8.241 8513 149	479	8.241 9294 767	959
088	8.241 8512 670	480	8.241 9295 726	960
089	8.241 8512 190	481	8.241 9296 686	961
.090	8.241 8511 709	481	8.241 9297 647	962
091	8.241 8511 228	481	8.241 9298 609	963
092	8.241 8510 747	482	8.241 9299 572	964
093	8.241 8510 265	482	8.241 9300 536	964
094	8.241 8509 783	483	8.241 9301 500	966
095	8.241 8509 300	483	8.241 9302 466	966
096	8.241 8508 817	483	8.241 9303 432	967
097	8.241 8508 334	484	8.241 9304 399	968
098	8.241 8507 850	485	8.241 9305 367	969
099	8.241 8507 365	485	8.241 9306 336	970
.100	8.241 8506 880		8.241 9307 306	
	S	d	T	d

1°	S	d	T	d
.100	8.241 8506 880	485	8.241 9307 306	971
101	8.241 8506 395	486	8.241 9308 277	972
102	8.241 8505 909	486	8.241 9309 249	972
103	8.241 8505 423	486	8.241 9310 221	974
104	8.241 8504 937	488	8.241 9311 195	974
105	8.241 8504 449	487	8.241 9312 169	975
106	8.241 8503 962	488	8.241 9313 144	976
107	8.241 8503 474	488	8.241 9314 120	977
108	8.241 8502 986	489	8.241 9315 097	978
109	8.241 8502 497	490	8.241 9316 075	979
.110	8.241 8502 007	489	8.241 9317 054	979
111	8.241 8501 518	490	8.241 9318 033	981
112	8.241 8501 028	491	8.241 9319 014	981
113	8.241 8500 537	491	8.241 9319 995	982
114	8.241 8500 046	492	8.241 9320 977	983
115	8.241 8499 554	491	8.241 9321 960	984
116	8.241 8499 063	493	8.241 9322 944	985
117	8.241 8498 570	493	8.241 9323 929	986
118	8.241 8498 077	493	8.241 9324 915	987
119	8.241 8497 584	494	8.241 9325 902	987
.120	8.241 8497 090	494	8.241 9326 889	989
121	8.241 8496 596	494	8.241 9327 878	989
122	8.241 8496 102	495	8.241 9328 867	990
123	8.241 8495 607	496	8.241 9329 857	991
124	8.241 8495 111	496	8.241 9330 848	992
125	8.241 8494 615	496	8.241 9331 840	993
126	8.241 8494 119	497	8.241 9332 833	994
127	8.241 8493 622	497	8.241 9333 827	994
128	8.241 8493 125	498	8.241 9334 821	996
129	8.241 8492 627	498	8.241 9335 817	996
.130	8.241 8492 129	498	8.241 9336 813	997
131	8.241 8491 631	499	8.241 9337 810	998
132	8.241 8491 132	500	8.241 9338 808	999
133	8.241 8490 632	500	8.241 9339 807	I 000
134	8.241 8490 132	500	8.241 9340 807	I 001
135	8.241 8489 632	501	8.241 9341 808	I 002
136	8.241 8489 131	501	8.241 9342 810	I 002
137	8.241 8488 630	501	8.241 9343 812	I 004
138	8.241 8488 129	502	8.241 9344 816	I 004
139	8.241 8487 627	503	8.241 9345 820	I 005
.140	8.241 8487 124	503	8.241 9346 825	I 006
141	8.241 8486 621	503	8.241 9347 831	I 007
142	8.241 8486 118	504	8.241 9348 838	I 008
143	8.241 8485 614	504	8.241 9349 846	I 009
144	8.241 8485 110	505	8.241 9350 855	I 009
145	8.241 8484 605	505	8.241 9351 864	I 011
146	8.241 8484 100	506	8.241 9352 875	I 011
147	8.241 8483 594	506	8.241 9353 886	I 012
148	8.241 8483 088	506	8.241 9354 898	I 013
149	8.241 8482 582	507	8.241 9355 911	I 014
.150	8.241 8482 075		8.241 9356 925	
	S	d	T	d

1°	S	d	T	d
.150	8.241 8482 075	508	8.241 9356 925	I 015
151	8.241 8481 567	507	8.241 9357 940	I 016
152	8.241 8481 060	509	8.241 9358 956	I 017
153	8.241 8480 551	508	8.241 9359 973	I 017
154	8.241 8480 043	510	8.241 9360 990	I 019
155	8.241 8479 533	509	8.241 9362 009	I 019
156	8.241 8479 024	510	8.241 9363 028	I 020
157	8.241 8478 514	511	8.241 9364 048	I 021
158	8.241 8478 003	510	8.241 9365 069	I 022
159	8.241 8477 493	512	8.241 9366 091	I 023
.160	8.241 8476 981	512	8.241 9367 114	I 024
161	8.241 8476 469	512	8.241 9368 138	I 024
162	8.241 8475 957	512	8.241 9369 162	I 026
163	8.241 8475 445	513	8.241 9370 188	I 026
164	8.241 8474 932	514	8.241 9371 214	I 027
165	8.241 8474 418	514	8.241 9372 241	I 028
166	8.241 8473 904	514	8.241 9373 269	I 029
167	8.241 8473 390	515	8.241 9374 298	I 030
168	8.241 8472 875	516	8.241 9375 328	I 031
169	8.241 8472 359	515	8.241 9376 359	I 032
.170	8.241 8471 844	516	8.241 9377 391	I 032
171	8.241 8471 328	517	8.241 9378 423	I 034
172	8.241 8470 811	517	8.241 9379 457	I 034
173	8.241 8470 294	518	8.241 9380 491	I 035
174	8.241 8469 776	518	8.241 9381 526	I 036
175	8.241 8469 258	518	8.241 9382 562	I 037
176	8.241 8468 740	519	8.241 9383 599	I 038
177	8.241 8468 221	519	8.241 9384 637	I 039
178	8.241 8467 702	520	8.241 9385 676	I 039
179	8.241 8467 182	520	8.241 9386 715	I 041
.180	8.241 8466 662	521	8.241 9387 756	I 041
181	8.241 8466 141	521	8.241 9388 797	I 042
182	8.241 8465 620	521	8.241 9389 839	I 043
183	8.241 8465 099	522	8.241 9390 882	I 044
184	8.241 8464 577	522	8.241 9391 926	I 045
185	8.241 8464 055	523	8.241 9392 971	I 046
186	8.241 8463 532	523	8.241 9394 017	I 047
187	8.241 8463 009	524	8.241 9395 064	I 047
188	8.241 8462 485	524	8.241 9396 111	I 049
189	8.241 8461 961	525	8.241 9397 160	I 049
.190	8.241 8461 436	525	8.241 9398 209	I 050
191	8.241 8460 911	525	8.241 9399 259	I 051
192	8.241 8460 386	526	8.241 9400 310	I 052
193	8.241 8459 860	526	8.241 9401 362	I 053
194	8.241 8459 334	527	8.241 9402 415	I 054
195	8.241 8458 807	527	8.241 9403 469	I 054
196	8.241 8458 280	528	8.241 9404 523	I 056
197	8.241 8457 752	528	8.241 9405 579	I 056
198	8.241 8457 224	529	8.241 9406 635	I 057
199	8.241 8456 695	529	8.241 9407 692	I 059
.200	8.241 8456 166		8.241 9408 751	
	S	d	T	d

1°	S	d	T	d
.200	8.241 8456 166	529	8.241 9408 751	I 059
201	8.241 8455 637	530	8.241 9409 810	I 059
202	8.241 8455 107	530	8.241 9410 869	I 061
203	8.241 8454 577	531	8.241 9411 930	I 062
204	8.241 8454 046	531	8.241 9412 992	I 062
205	8.241 8453 515	532	8.241 9414 054	I 064
206	8.241 8452 983	532	8.241 9415 118	I 064
207	8.241 8452 451	532	8.241 9416 182	I 065
208	8.241 8451 919	533	8.241 9417 247	I 066
209	8.241 8451 386	533	8.241 9418 313	I 067
.210	8.241 8450 853	534	8.241 9419 380	I 068
211	8.241 8450 319	535	8.241 9420 448	I 069
212	8.241 8449 784	534	8.241 9421 517	I 069
213	8.241 8449 250	535	8.241 9422 586	I 071
214	8.241 8448 715	536	8.241 9423 657	I 071
215	8.241 8448 179	536	8.241 9424 728	I 073
216	8.241 8447 643	536	8.241 9425 801	I 073
217	8.241 8447 107	537	8.241 9426 874	I 074
218	8.241 8446 570	538	8.241 9427 948	I 075
219	8.241 8446 032	538	8.241 9429 023	I 075
.220	8.241 8445 494	538	8.241 9430 098	I 077
221	8.241 8444 956	538	8.241 9431 175	I 078
222	8.241 8444 418	540	8.241 9432 253	I 078
223	8.241 8443 878	539	8.241 9433 331	I 079
224	8.241 8443 339	540	8.241 9434 410	I 080
225	8.241 8442 799	541	8.241 9435 490	I 082
226	8.241 8442 258	540	8.241 9436 572	I 081
227	8.241 8441 718	542	8.241 9437 653	I 083
228	8.241 8441 176	541	8.241 9438 736	I 084
229	8.241 8440 635	543	8.241 9439 820	I 085
.230	8.241 8440 092	542	8.241 9440 905	I 085
231	8.241 8439 550	543	8.241 9441 990	I 086
232	8.241 8439 007	544	8.241 9443 076	I 088
233	8.241 8438 463	544	8.241 9444 164	I 088
234	8.241 8437 919	544	8.241 9445 252	I 089
235	8.241 8437 375	545	8.241 9446 341	I 090
236	8.241 8436 830	545	8.241 9447 431	I 091
237	8.241 8436 285	546	8.241 9448 522	I 091
238	8.241 8435 739	546	8.241 9449 613	I 093
239	8.241 8435 193	547	8.241 9450 706	I 093
.240	8.241 8434 646	547	8.241 9451 799	I 094
241	8.241 8434 099	547	8.241 9452 893	I 096
242	8.241 8433 552	548	8.241 9453 989	I 096
243	8.241 8433 004	549	8.241 9455 085	I 097
244	8.241 8432 455	549	8.241 9456 182	I 098
245	8.241 8431 906	549	8.241 9457 280	I 098
246	8.241 8431 357	550	8.241 9458 378	I 100
247	8.241 8430 807	550	8.241 9459 478	I 100
248	8.241 8430 257	550	8.241 9460 578	I 102
249	8.241 8429 707	551	8.241 9461 680	I 102
.250	8.241 8429 156		8.241 9462 782	
	S	d	T	d

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.250	8.241 8429 156	552	8.241 9462 782	I 103
251	8.241 8428 604	552	8.241 9463 885	I 104
252	8.241 8428 052	552	8.241 9464 989	I 105
253	8.241 8427 500	553	8.241 9466 094	I 106
254	8.241 8426 947	553	8.241 9467 200	I 106
255	8.241 8426 394	554	8.241 9468 306	I 108
256	8.241 8425 840	554	8.241 9469 414	I 108
257	8.241 8425 286	554	8.241 9470 522	I 110
258	8.241 8424 732	555	8.241 9471 632	I 110
259	8.241 8424 177	556	8.241 9472 742	I 111
.260	8.241 8423 621	556	8.241 9473 853	I 112
261	8.241 8423 065	556	8.241 9474 965	I 113
262	8.241 8422 509	557	8.241 9476 078	I 114
263	8.241 8421 952	557	8.241 9477 192	I 114
264	8.241 8421 395	558	8.241 9478 306	I 116
265	8.241 8420 837	558	8.241 9479 422	I 116
266	8.241 8420 279	558	8.241 9480 538	I 117
267	8.241 8419 721	559	8.241 9481 655	I 118
268	8.241 8419 162	559	8.241 9482 773	I 119
269	8.241 8418 603	560	8.241 9483 892	I 120
.270	8.241 8418 043	561	8.241 9485 012	I 121
271	8.241 8417 482	560	8.241 9486 133	I 122
272	8.241 8416 922	562	8.241 9487 255	I 122
273	8.241 8416 360	561	8.241 9488 377	I 124
274	8.241 8415 799	562	8.241 9489 501	I 124
275	8.241 8415 237	563	8.241 9490 625	I 125
276	8.241 8414 674	563	8.241 9491 750	I 126
277	8.241 8414 111	563	8.241 9492 876	I 127
278	8.241 8413 548	564	8.241 9494 003	I 128
279	8.241 8412 984	564	8.241 9495 131	I 129
.280	8.241 8412 420	565	8.241 9496 260	I 129
281	8.241 8411 855	565	8.241 9497 389	I 131
282	8.241 8411 290	565	8.241 9498 520	I 131
283	8.241 8410 725	566	8.241 9499 651	I 133
284	8.241 8410 159	567	8.241 9500 784	I 133
285	8.241 8409 592	567	8.241 9501 917	I 134
286	8.241 8409 025	567	8.241 9503 051	I 135
287	8.241 8408 458	568	8.241 9504 186	I 135
288	8.241 8407 890	568	8.241 9505 321	I 137
289	8.241 8407 322	569	8.241 9506 458	I 138
.290	8.241 8406 753	569	8.241 9507 596	I 138
291	8.241 8406 184	569	8.241 9508 734	I 139
292	8.241 8405 615	570	8.241 9509 873	I 141
293	8.241 8405 045	571	8.241 9511 014	I 141
294	8.241 8404 474	571	8.241 9512 155	I 142
295	8.241 8403 903	571	8.241 9513 297	I 143
296	8.241 8403 332	572	8.241 9514 440	I 143
297	8.241 8402 760	572	8.241 9515 583	I 145
298	8.241 8402 188	573	8.241 9516 728	I 145
299	8.241 8401 615	573	8.241 9517 873	I 147
.300	8.241 8401 042		8.241 9519 020	
	S	d	T	d

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.300	8.241 8401 042	573	8.241 9519 020	I 147
301	8.241 8400 469	574	8.241 9520 167	I 148
302	8.241 8399 895	575	8.241 9521 315	I 149
303	8.241 8399 320	574	8.241 9522 464	I 150
304	8.241 8398 746	576	8.241 9523 614	I 151
305	8.241 8398 170	575	8.241 9524 765	I 152
306	8.241 8397 595	576	8.241 9525 917	I 152
307	8.241 8397 019	577	8.241 9527 069	I 154
308	8.241 8396 442	577	8.241 9528 223	I 154
309	8.241 8395 865	578	8.241 9529 377	I 155
.310	8.241 8395 287	578	8.241 9530 532	I 156
311	8.241 8394 709	578	8.241 9531 688	I 157
312	8.241 8394 131	579	8.241 9532 845	I 158
313	8.241 8393 552	579	8.241 9534 003	I 159
314	8.241 8392 973	580	8.241 9535 162	I 159
315	8.241 8392 393	580	8.241 9536 321	I 161
316	8.241 8391 813	580	8.241 9537 482	I 161
317	8.241 8391 233	581	8.241 9538 643	I 163
318	8.241 8390 652	582	8.241 9539 806	I 163
319	8.241 8390 070	582	8.241 9540 969	I 164
.320	8.241 8389 488	582	8.241 9542 133	I 165
321	8.241 8388 906	583	8.241 9543 298	I 165
322	8.241 8388 323	583	8.241 9544 463	I 167
323	8.241 8387 740	584	8.241 9545 630	I 168
324	8.241 8387 156	584	8.241 9546 798	I 168
325	8.241 8386 572	584	8.241 9547 966	I 169
326	8.241 8385 988	585	8.241 9549 135	I 171
327	8.241 8385 403	586	8.241 9550 306	I 171
328	8.241 8384 817	586	8.241 9551 477	I 172
329	8.241 8384 231	586	8.241 9552 649	I 173
.330	8.241 8383 645	587	8.241 9553 822	I 173
331	8.241 8383 058	587	8.241 9554 995	I 175
332	8.241 8382 471	587	8.241 9556 170	I 175
333	8.241 8381 884	588	8.241 9557 345	I 177
334	8.241 8381 296	589	8.241 9558 522	I 177
335	8.241 8380 707	589	8.241 9559 699	I 178
336	8.241 8380 118	589	8.241 9560 877	I 179
337	8.241 8379 529	590	8.241 9562 056	I 180
338	8.241 8378 939	590	8.241 9563 236	I 181
339	8.241 8378 349	591	8.241 9564 417	I 182
.340	8.241 8377 758	591	8.241 9565 599	I 182
341	8.241 8377 167	592	8.241 9566 781	I 184
342	8.241 8376 575	592	8.241 9567 965	I 184
343	8.241 8375 983	592	8.241 9569 149	I 185
344	8.241 8375 391	593	8.241 9570 334	I 186
345	8.241 8374 798	594	8.241 9571 520	I 187
346	8.241 8374 204	593	8.241 9572 707	I 188
347	8.241 8373 611	595	8.241 9573 895	I 189
348	8.241 8373 016	594	8.241 9575 084	I 190
349	8.241 8372 422	596	8.241 9576 274	I 190
.350	8.241 8371 826		8.241 9577 464	
	S	d	T	d

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.350	8.241 8371 826	595	8.241 9577 464	I 191
351	8.241 8371 231	596	8.241 9578 655	I 193
352	8.241 8370 635	597	8.241 9579 848	I 193
353	8.241 8370 038	596	8.241 9581 041	I 194
354	8.241 8369 442	598	8.241 9582 235	I 195
355	8.241 8368 844	598	8.241 9583 430	I 196
356	8.241 8368 246	598	8.241 9584 626	I 196
357	8.241 8367 648	598	8.241 9585 822	I 198
358	8.241 8367 050	599	8.241 9587 020	I 198
359	8.241 8366 451	600	8.241 9588 218	I 200
.360	8.241 8365 851	600	8.241 9589 418	I 200
361	8.241 8365 251	600	8.241 9590 618	I 201
362	8.241 8364 651	601	8.241 9591 819	I 202
363	8.241 8364 050	602	8.241 9593 021	I 203
364	8.241 8363 448	601	8.241 9594 224	I 204
365	8.241 8362 847	602	8.241 9595 428	I 204
366	8.241 8362 245	603	8.241 9596 632	I 206
367	8.241 8361 642	603	8.241 9597 838	I 206
368	8.241 8361 039	604	8.241 9599 044	I 207
369	8.241 8360 435	604	8.241 9600 251	I 209
.370	8.241 8359 831	604	8.241 9601 460	I 209
371	8.241 8359 227	605	8.241 9602 669	I 210
372	8.241 8358 622	605	8.241 9603 879	I 210
373	8.241 8358 017	606	8.241 9605 089	I 212
374	8.241 8357 411	606	8.241 9606 301	I 213
375	8.241 8356 805	607	8.241 9607 514	I 213
376	8.241 8356 198	607	8.241 9608 727	I 214
377	8.241 8355 591	607	8.241 9609 941	I 216
378	8.241 8354 984	608	8.241 9611 157	I 216
379	8.241 8354 376	608	8.241 9612 373	I 217
.380	8.241 8353 768	609	8.241 9613 590	I 218
381	8.241 8353 159	609	8.241 9614 808	I 218
382	8.241 8352 550	610	8.241 9616 026	I 220
383	8.241 8351 940	610	8.241 9617 246	I 221
384	8.241 8351 330	611	8.241 9618 467	I 221
385	8.241 8350 719	611	8.241 9619 688	I 222
386	8.241 8350 108	611	8.241 9620 910	I 223
387	8.241 8349 497	612	8.241 9622 133	I 224
388	8.241 8348 885	612	8.241 9623 357	I 225
389	8.241 8348 273	613	8.241 9624 582	I 226
.390	8.241 8347 660	613	8.241 9625 808	I 227
391	8.241 8347 047	614	8.241 9627 035	I 228
392	8.241 8346 433	614	8.241 9628 263	I 228
393	8.241 8345 819	615	8.241 9629 491	I 229
394	8.241 8345 204	615	8.241 9630 720	I 231
395	8.241 8344 589	615	8.241 9631 951	I 231
396	8.241 8343 974	616	8.241 9633 182	I 232
397	8.241 8343 358	616	8.241 9634 414	I 233
398	8.241 8342 742	617	8.241 9635 647	I 233
399	8.241 8342 125	617	8.241 9636 880	I 235
.400	8.241 8341 508		8.241 9638 115	
	S	d	T	d

1°	S	d	T	d
.400	8.241 8341 508	618	8.241 9638 115	I 235
401	8.241 8340 890	618	8.241 9639 350	I 237
402	8.241 8340 272	618	8.241 9640 587	I 237
403	8.241 8339 654	619	8.241 9641 824	I 238
404	8.241 8339 035	619	8.241 9643 062	I 239
405	8.241 8338 416	620	8.241 9644 301	I 240
406	8.241 8337 796	621	8.241 9645 541	I 241
407	8.241 8337 175	620	8.241 9646 782	I 242
408	8.241 8336 555	621	8.241 9648 024	I 242
409	8.241 8335 934	622	8.241 9649 266	I 244
.410	8.241 8335 312	622	8.241 9650 510	I 244
411	8.241 8334 690	622	8.241 9651 754	I 246
412	8.241 8334 068	623	8.241 9653 000	I 246
413	8.241 8333 445	624	8.241 9654 246	I 247
414	8.241 8332 821	624	8.241 9655 493	I 248
415	8.241 8332 197	624	8.241 9656 741	I 248
416	8.241 8331 573	624	8.241 9657 989	I 250
417	8.241 8330 949	626	8.241 9659 239	I 250
418	8.241 8330 323	625	8.241 9660 489	I 252
419	8.241 8329 698	626	8.241 9661 741	I 252
.420	8.241 8329 072	627	8.241 9662 993	I 253
421	8.241 8328 445	626	8.241 9664 246	I 254
422	8.241 8327 819	628	8.241 9665 500	I 255
423	8.241 8327 191	627	8.241 9666 755	I 256
424	8.241 8326 564	629	8.241 9668 011	I 257
425	8.241 8325 935	628	8.241 9669 268	I 258
426	8.241 8325 307	629	8.241 9670 526	I 258
427	8.241 8324 678	630	8.241 9671 784	I 259
428	8.241 8324 048	630	8.241 9673 043	I 261
429	8.241 8323 418	630	8.241 9674 304	I 261
.430	8.241 8322 788	631	8.241 9675 565	I 262
431	8.241 8322 157	631	8.241 9676 827	I 263
432	8.241 8321 526	632	8.241 9678 090	I 263
433	8.241 8320 894	632	8.241 9679 353	I 265
434	8.241 8320 262	633	8.241 9680 618	I 266
435	8.241 8319 629	633	8.241 9681 884	I 266
436	8.241 8318 996	634	8.241 9683 150	I 267
437	8.241 8318 362	633	8.241 9684 417	I 268
438	8.241 8317 729	635	8.241 9685 685	I 270
439	8.241 8317 094	635	8.241 9686 955	I 270
.440	8.241 8316 459	635	8.241 9688 225	I 270
441	8.241 8315 824	636	8.241 9689 495	I 272
442	8.241 8315 188	636	8.241 9690 767	I 273
443	8.241 8314 552	636	8.241 9692 040	I 273
444	8.241 8313 916	637	8.241 9693 313	I 275
445	8.241 8313 279	638	8.241 9694 588	I 275
446	8.241 8312 641	638	8.241 9695 863	I 276
447	8.241 8312 003	638	8.241 9697 139	I 277
448	8.241 8311 365	639	8.241 9698 416	I 278
449	8.241 8310 726	639	8.241 9699 694	I 279
.450	8.241 8310 087		8.241 9700 973	
	S	d	T	d

1°	S	d	T	d
.450	8.241 8310 087	640	8.241 9700 973	I 279
451	8.241 8309 447	640	8.241 9702 252	I 281
452	8.241 8308 807	640	8.241 9703 533	I 281
453	8.241 8308 167	641	8.241 9704 814	I 283
454	8.241 8307 526	642	8.241 9706 097	I 283
455	8.241 8306 884	642	8.241 9707 380	I 284
456	8.241 8306 242	642	8.241 9708 664	I 285
457	8.241 8305 600	643	8.241 9709 949	I 286
458	8.241 8304 957	643	8.241 9711 235	I 286
459	8.241 8304 314	644	8.241 9712 521	I 288
460	8.241 8303 670	644	8.241 9713 809	I 288
461	8.241 8303 026	644	8.241 9715 097	I 290
462	8.241 8302 382	645	8.241 9716 387	I 290
463	8.241 8301 737	646	8.241 9717 677	I 291
464	8.241 8301 091	645	8.241 9718 968	I 292
465	8.241 8300 446	647	8.241 9720 260	I 293
466	8.241 8299 799	646	8.241 9721 553	I 294
467	8.241 8299 153	648	8.241 9722 847	I 295
468	8.241 8298 505	647	8.241 9724 142	I 295
469	8.241 8297 858	648	8.241 9725 437	I 297
470	8.241 8297 210	649	8.241 9726 734	I 297
471	8.241 8296 561	649	8.241 9728 031	I 298
472	8.241 8295 912	649	8.241 9729 329	I 299
473	8.241 8295 263	650	8.241 9730 628	I 300
474	8.241 8294 613	650	8.241 9731 928	I 301
475	8.241 8293 963	651	8.241 9733 229	I 302
476	8.241 8293 312	651	8.241 9734 531	I 302
477	8.241 8292 661	651	8.241 9735 833	I 304
478	8.241 8292 010	652	8.241 9737 137	I 304
479	8.241 8291 358	653	8.241 9738 441	I 305
480	8.241 8290 705	653	8.241 9739 746	I 307
481	8.241 8290 052	653	8.241 9741 053	I 307
482	8.241 8289 399	654	8.241 9742 360	I 308
483	8.241 8288 745	654	8.241 9743 668	I 308
484	8.241 8288 091	655	8.241 9744 976	I 310
485	8.241 8287 436	655	8.241 9746 286	I 311
486	8.241 8286 781	655	8.241 9747 597	I 311
487	8.241 8286 126	656	8.241 9748 908	I 312
488	8.241 8285 470	657	8.241 9750 220	I 314
489	8.241 8284 813	657	8.241 9751 534	I 314
490	8.241 8284 156	657	8.241 9752 848	I 315
491	8.241 8283 499	658	8.241 9754 163	I 315
492	8.241 8282 841	658	8.241 9755 478	I 317
493	8.241 8282 183	659	8.241 9756 795	I 318
494	8.241 8281 524	659	8.241 9758 113	I 318
495	8.241 8280 865	659	8.241 9759 431	I 320
496	8.241 8280 206	660	8.241 9760 751	I 320
497	8.241 8279 546	661	8.241 9762 071	I 321
498	8 241 8278 885	660	8.241 9763 392	I 322
499	8.241 8278 225	662	8.241 9764 714	I 323
.500	8.241 8277 563		8.241 9766 037	
	S	d	T	d

1°	S	d	T	d
.500	8.241 8277 563	661	8.241 9766 037	I 324
501	8.241 8276 902	663	8.241 9767 361	I 325
502	8.241 8276 239	662	8.241 9768 686	I 325
503	8.241 8275 577	663	8.241 9770 011	I 327
504	8.241 8274 914	664	8.241 9771 338	I 327
505	8.241 8274 250	664	8.241 9772 665	I 328
506	8.241 8273 586	664	8.241 9773 993	I 329
507	8.241 8272 922	665	8.241 9775 322	I 330
508	8.241 8272 257	665	8.241 9776 652	I 331
509	8.241 8271 592	666	8.241 9777 983	I 332
.510	8.241 8270 926	666	8.241 9779 315	I 332
511	8.241 8270 260	666	8.241 9780 647	I 334
512	8.241 8269 594	667	8.241 9781 981	I 334
513	8.241 8268 927	668	8.241 9783 315	I 336
514	8.241 8268 259	668	8.241 9784 651	I 336
515	8.241 8267 591	668	8.241 9785 987	I 337
516	8.241 8266 923	669	8.241 9787 324	I 338
517	8.241 8266 254	669	8.241 9788 662	I 339
518	8.241 8265 585	670	8.241 9790 001	I 339
519	8.241 8264 915	670	8.241 9791 340	I 341
.520	8.241 8264 245	670	8.241 9792 681	I 341
521	8.241 8263 575	671	8.241 9794 022	I 343
522	8.241 8262 904	672	8.241 9795 365	I 343
523	8.241 8262 232	672	8.241 9796 708	I 344
524	8.241 8261 560	672	8.241 9798 052	I 345
525	8.241 8260 888	673	8.241 9799 397	I 346
526	8.241 8260 215	673	8.241 9800 743	I 347
527	8.241 8259 542	674	8.241 9802 090	I 347
528	8.241 8258 868	674	8.241 9803 437	I 349
529	8.241 8258 194	674	8.241 9804 786	I 349
.530	8.241 8257 520	675	8.241 9806 135	I 350
531	8.241 8256 845	675	8.241 9807 485	I 352
532	8.241 8256 170	676	8.241 9808 837	I 352
533	8.241 8255 494	677	8.241 9810 189	I 353
534	8.241 8254 817	676	8.241 9811 542	I 353
535	8.241 8254 141	677	8.241 9812 895	I 355
536	8.241 8253 464	678	8.241 9814 250	I 356
537	8.241 8252 786	678	8.241 9815 606	I 356
538	8.241 8252 108	679	8.241 9816 962	I 358
539	8.241 8251 429	678	8.241 9818 320	I 358
.540	8.241 8250 751	680	8.241 9819 678	I 359
541	8.241 8250 071	680	8.241 9821 037	I 360
542	8.241 8249 391	680	8.241 9822 397	I 361
543	8.241 8248 711	681	8.241 9823 758	I 362
544	8.241 8248 030	681	8.241 9825 120	I 362
545	8.241 8247 349	681	8.241 9826 482	I 364
546	8.241 8246 668	682	8.241 9827 846	I 364
547	8.241 8245 986	683	8.241 9829 210	I 365
548	8.241 8245 303	683	8.241 9830 575	I 367
549	8.241 8244 620	683	8.241 9831 942	I 367
.550	8.241 8243 937		8.241 9833 309	
	S	d	T	d

1°	S	d	T	d
.550	8.241 8243 937	684	8.241 9833 309	I 368
551	8.241 8243 253	684	8.241 9834 677	I 368
552	8.241 8242 569	685	8.241 9836 045	I 370
553	8.241 8241 884	685	8.241 9837 415	I 371
554	8.241 8241 199	685	8.241 9838 786	I 371
555	8.241 8240 514	686	8.241 9840 157	I 373
556	8.241 8239 828	687	8.241 9841 530	I 373
557	8.241 8239 141	686	8.241 9842 903	I 374
558	8.241 8238 455	688	8.241 9844 277	I 375
559	8.241 8237 767	687	8.241 9845 652	I 376
.560	8.241 8237 080	689	8.241 9847 028	I 377
561	8.241 8236 391	688	8.241 9848 405	I 377
562	8.241 8235 703	689	8.241 9849 782	I 379
563	8.241 8235 014	690	8.241 9851 161	I 379
564	8.241 8234 324	690	8.241 9852 540	I 380
565	8.241 8233 634	690	8.241 9853 920	I 382
566	8.241 8232 944	691	8.241 9855 302	I 382
567	8.241 8232 253	691	8.241 9856 684	I 383
568	8.241 8231 562	692	8.241 9858 067	I 384
569	8.241 8230 870	692	8.241 9859 451	I 384
.570	8.241 8230 178	693	8.241 9860 835	I 386
571	8.241 8229 485	693	8.241 9862 221	I 386
572	8.241 8228 792	693	8.241 9863 607	I 388
573	8.241 8228 099	694	8.241 9864 995	I 388
574	8.241 8227 405	694	8.241 9866 383	I 389
575	8.241 8226 711	695	8.241 9867 772	I 390
576	8.241 8226 016	696	8.241 9869 162	I 391
577	8.241 8225 320	695	8.241 9870 553	I 392
578	8.241 8224 625	696	8.241 9871 945	I 392
579	8.241 8223 929	697	8.241 9873 337	I 394
.580	8.241 8223 232	697	8.241 9874 731	I 394
581	8.241 8222 535	697	8.241 9876 125	I 396
582	8.241 8221 838	698	8.241 9877 521	I 396
583	8.241 8221 140	699	8.241 9878 917	I 397
584	8.241 8220 441	698	8.241 9880 314	I 398
585	8.241 8219 743	700	8.241 9881 712	I 399
586	8.241 8219 043	699	8.241 9883 111	I 400
587	8.241 8218 344	700	8.241 9884 511	I 400
588	8.241 8217 644	701	8.241 9885 911	I 402
589	8.241 8216 943	701	8.241 9887 313	I 402
.590	8.241 8216 242	701	8.241 9888 715	I 403
591	8.241 8215 541	702	8.241 9890 118	I 404
592	8.241 8214 839	702	8.241 9891 522	I 405
593	8.241 8214 137	703	8.241 9892 927	I 406
594	8.241 8213 434	703	8.241 9894 333	I 407
595	8.241 8212 731	704	8.241 9895 740	I 408
596	8.241 8212 027	704	8.241 9897 148	I 408
597	8.241 8211 323	704	8.241 9898 556	I 410
598	8.241 8210 619	705	8.241 9899 966	I 410
599	8.241 8209 914	706	8.241 9901 376	I 411
.600	8.241 8209 208		8.241 9902 787	
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.600	8.241 8209 208	706	8.241 9902 787	I 412
601	8.241 8208 502	706	8.241 9904 199	I 413
602	8.241 8207 796	707	8.241 9905 612	I 414
603	8.241 8207 089	707	8.241 9907 026	I 415
604	8.241 8206 382	707	8.241 9908 441	I 416
605	8.241 8205 675	708	8.241 9909 857	I 416
606	8.241 8204 967	709	8.241 9911 273	I 417
607	8.241 8204 258	709	8.241 9912 690	I 419
608	8.241 8203 549	709	8.241 9914 109	I 419
609	8.241 8202 840	710	8.241 9915 528	I 420
.610	8.241 8202 130	710	8.241 9916 948	I 421
611	8.241 8201 420	711	8.241 9918 369	I 422
612	8.241 8200 709	711	8.241 9919 791	I 422
613	8.241 8199 998	711	8.241 9921 213	I 424
614	8.241 8199 287	712	8.241 9922 637	I 424
615	8.241 8198 575	713	8.241 9924 061	I 426
616	8.241 8197 862	713	8.241 9925 487	I 426
617	8.241 8197 149	713	8.241 9926 913	I 427
618	8.241 8196 436	714	8.241 9928 340	I 428
619	8.241 8195 722	714	8.241 9929 768	I 429
.620	8.241 8195 008	715	8.241 9931 197	I 430
621	8.241 8194 293	715	8.241 9932 627	I 430
622	8.241 8193 578	715	8.241 9934 057	I 432
623	8.241 8192 863	716	8.241 9935 489	I 432
624	8.241 8192 147	717	8.241 9936 921	I 433
625	8.241 8191 430	716	8.241 9938 354	I 435
626	8.241 8190 714	718	8.241 9939 789	I 435
627	8.241 8189 996	718	8.241 9941 224	I 435
628	8.241 8189 278	718	8.241 9942 659	I 437
629	8.241 8188 560	718	8.241 9944 096	I 438
.630	8.241 8187 842	719	8.241 9945 534	I 439
631	8.241 8187 123	720	8.241 9946 973	I 439
632	8.241 8186 403	720	8.241 9948 412	I 440
633	8.241 8185 683	720	8.241 9949 852	I 442
634	8.241 8184 963	721	8.241 9951 294	I 442
635	8.241 8184 242	721	8.241 9952 736	I 443
636	8.241 8183 521	722	8.241 9954 179	I 444
637	8.241 8182 799	722	8.241 9955 623	I 444
638	8.241 8182 077	723	8.241 9957 067	I 446
639	8.241 8181 354	723	8.241 9958 513	I 446
.640	8.241 8180 631	723	8.241 9959 959	I 448
641	8.241 8179 908	724	8.241 9961 407	I 448
642	8.241 8179 184	724	8.241 9962 855	I 449
643	8.241 8178 460	725	8.241 9964 304	I 450
644	8.241 8177 735	725	8.241 9965 754	I 451
645	8.241 8177 010	726	8.241 9967 205	I 452
646	8.241 8176 284	726	8.241 9968 657	I 453
647	8.241 8175 558	727	8.241 9970 110	I 453
648	8.241 8174 831	727	8.241 9971 563	I 455
649	8.241 8174 104	727	8.241 9973 018	I 455
.650	8.241 8173 377		8.241 9974 473	
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651	8.241 8172 649	728	8.241 9975 930	I 457
652	8.241 8171 921	729	8.241 9977 387	I 458
653	8.241 8171 192	729	8.241 9978 845	I 459
654	8.241 8170 463	730	8.241 9980 304	I 459
655	8.241 8169 733	730	8.241 9981 763	I 461
656	8.241 8169 003	731	8.241 9983 224	I 461
657	8.241 8168 272	731	8.241 9984 685	I 463
658	8.241 8167 541	731	8.241 9986 148	I 463
659	8.241 8166 810	732	8.241 9987 611	I 464
.660	8.241 8166 078	732	8.241 9989 075	I 465
661	8.241 8165 346	733	8.241 9990 540	I 466
662	8.241 8164 613	733	8.241 9992 006	I 467
663	8.241 8163 880	734	8.241 9993 473	I 468
664	8.241 8163 146	734	8.241 9994 941	I 469
665	8.241 8162 412	734	8.241 9996 410	I 469
666	8.241 8161 678	735	8.241 9997 879	I 470
667	8.241 8160 943	735	8.241 9999 349	I 472
668	8.241 8160 208	736	8.242 0000 821	I 472
669	8.241 8159 472	737	8.242 0002 293	I 473
.670	8.241 8158 735	736	8.242 0003 766	I 474
671	8.241 8157 999	737	8.242 0005 240	I 474
672	8.241 8157 262	738	8.242 0006 714	I 476
673	8.241 8156 524	738	8.242 0008 190	I 477
674	8.241 8155 786	738	8.242 0009 667	I 477
675	8.241 8155 048	739	8.242 0011 144	I 478
676	8.241 8154 309	740	8.242 0012 622	I 480
677	8.241 8153 569	739	8.242 0014 102	I 480
678	8.241 8152 830	741	8.242 0015 582	I 481
679	8.241 8152 089	740	8.242 0017 063	I 481
.680	8.241 8151 349	741	8.242 0018 544	I 483
681	8.241 8150 608	742	8.242 0020 027	I 484
682	8.241 8149 866	742	8.242 0021 511	I 484
683	8.241 8149 124	742	8.242 0022 995	I 486
684	8.241 8148 382	743	8.242 0024 481	I 486
685	8.241 8147 639	744	8.242 0025 967	I 487
686	8.241 8146 895	743	8.242 0027 454	I 488
687	8.241 8146 152	745	8.242 0028 942	I 489
688	8.241 8145 407	744	8.242 0030 431	I 490
689	8.241 8144 663	745	8.242 0031 921	I 490
.690	8.241 8143 918	746	8.242 0033 411	I 492
691	8.241 8143 172	746	8.242 0034 903	I 492
692	8.241 8142 426	746	8.242 0036 395	I 494
693	8.241 8141 680	747	8.242 0037 889	I 494
694	8.241 8140 933	747	8.242 0039 383	I 495
695	8.241 8140 186	748	8.242 0040 878	I 496
696	8.241 8139 438	748	8.242 0042 374	I 497
697	8.241 8138 690	749	8.242 0043 871	I 498
698	8.241 8137 941	749	8.242 0045 369	I 498
699	8.241 8137 192	749	8.242 0046 867	I 500
.700	8.241 8136 443		8.242 0048 367	
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701	8.241 8135 693	751	8.242 0049 867	I 501
702	8.241 8134 942	750	8.242 0051 368	I 503
703	8.241 8134 192	752	8.242 0052 871	I 503
704	8.241 8133 440	751	8.242 0054 374	I 503
705	8.241 8132 689	752	8.242 0055 877	I 505
706	8.241 8131 937	753	8.242 0057 382	I 506
707	8.241 8131 184	753	8.242 0058 888	I 507
708	8.241 8130 431	754	8.242 0060 395	I 507
709	8.241 8129 677	753	8.242 0061 902	I 508
.710	8.241 8128 924	755	8.242 0063 410	I 510
711	8.241 8128 169	755	8.242 0064 920	I 510
712	8.241 8127 414	755	8.242 0066 430	I 511
713	8.241 8126 659	755	8.242 0067 941	I 511
714	8.241 8125 904	757	8.242 0069 452	I 513
715	8.241 8125 147	756	8.242 0070 965	I 514
716	8.241 8124 391	757	8.242 0072 479	I 514
717	8.241 8123 634	757	8.242 0073 993	I 516
718	8.241 8122 877	758	8.242 0075 509	I 516
719	8.241 8122 119	759	8.242 0077 025	I 517
.720	8.241 8121 360	758	8.242 0078 542	I 518
721	8.241 8120 602	760	8.242 0080 060	I 519
722	8.241 8119 842	759	8.242 0081 579	I 520
723	8.241 8119 083	760	8.242 0083 099	I 521
724	8.241 8118 323	761	8.242 0084 620	I 521
725	8.241 8117 562	761	8.242 0086 141	I 523
726	8.241 8116 801	761	8.242 0087 664	I 523
727	8.241 8116 040	762	8.242 0089 187	I 524
728	8.241 8115 278	762	8.242 0090 711	I 525
729	8.241 8114 516	763	8.242 0092 236	I 526
.730	8.241 8113 753	763	8.242 0093 762	I 527
731	8.241 8112 990	764	8.242 0095 289	I 528
732	8.241 8112 226	764	8.242 0096 817	I 529
733	8.241 8111 462	764	8.242 0098 346	I 529
734	8.241 8110 698	765	8.242 0099 875	I 531
735	8.241 8109 933	766	8.242 0101 406	I 531
736	8.241 8109 167	765	8.242 0102 937	I 532
737	8.241 8108 402	767	8.242 0104 469	I 533
738	8.241 8107 635	766	8.242 0106 002	I 534
739	8.241 8106 869	767	8.242 0107 536	I 535
.740	8.241 8106 102	768	8.242 0109 071	I 536
741	8.241 8105 334	768	8.242 0110 607	I 536
742	8.241 8104 566	768	8.242 0112 143	I 538
743	8.241 8103 798	769	8.242 0113 681	I 538
744	8.241 8103 029	770	8.242 0115 219	I 539
745	8.241 8102 259	769	8.242 0116 758	I 540
746	8.241 8101 490	771	8.242 0118 298	I 541
747	8.241 8100 719	770	8.242 0119 839	I 542
748	8.241 8099 949	771	8.242 0121 381	I 543
749	8.241 8099 178	772	8.242 0122 924	I 544
.750	8.241 8098 406		8.242 0124 468	
	S	d	T	d

1°	S	d	T	d
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751	8.241 8097 634	772	8.242 0126 012	I 546
752	8.241 8096 862	773	8.242 0127 558	I 546
753	8.241 8096 089	774	8.242 0129 104	I 547
754	8.241 8095 315	773	8.242 0130 651	I 548
755	8.241 8094 542	775	8.242 0132 199	I 549
756	8.241 8093 767	774	8.242 0133 748	I 550
757	8.241 8092 993	775	8.242 0135 298	I 551
758	8.241 8092 218	776	8.242 0136 849	I 551
759	8.241 8091 442	776	8.242 0138 400	I 553
.760	8.241 8090 666	776	8.242 0139 953	I 553
761	8.241 8089 890	777	8.242 0141 506	I 555
762	8.241 8089 113	777	8.242 0143 061	I 555
763	8.241 8088 336	778	8.242 0144 616	I 556
764	8.241 8087 558	778	8.242 0146 172	I 557
765	8.241 8086 780	779	8.242 0147 729	I 557
766	8.241 8086 001	779	8.242 0149 286	I 559
767	8.241 8085 222	779	8.242 0150 845	I 560
768	8.241 8084 443	780	8.242 0152 405	I 560
769	8.241 8083 663	780	8.242 0153 965	I 561
.770	8.241 8082 883	781	8.242 0155 526	I 563
771	8.241 8082 102	781	8.242 0157 089	I 563
772	8.241 8081 321	782	8.242 0158 652	I 564
773	8.241 8080 539	782	8.242 0160 216	I 564
774	8.241 8079 757	783	8.242 0161 780	I 566
775	8.241 8078 974	783	8.242 0163 346	I 567
776	8.241 8078 191	783	8.242 0164 913	I 567
777	8.241 8077 408	784	8.242 0166 480	I 569
778	8.241 8076 624	785	8.242 0168 049	I 569
779	8.241 8075 839	784	8.242 0169 618	I 570
.780	8.241 8075 055	786	8.242 0171 188	I 571
781	8.241 8074 269	785	8.242 0172 759	I 572
782	8.241 8073 484	786	8.242 0174 331	I 573
783	8.241 8072 698	787	8.242 0175 904	I 574
784	8.241 8071 911	787	8.242 0177 478	I 574
785	8.241 8071 124	787	8.242 0179 052	I 576
786	8.241 8070 337	788	8.242 0180 628	I 576
787	8.241 8069 549	788	8.242 0182 204	I 577
788	8.241 8068 761	789	8.242 0183 781	I 578
789	8.241 8067 972	789	8.242 0185 359	I 579
.790	8.241 8067 183	790	8.242 0186 938	I 580
791	8.241 8066 393	790	8.242 0188 518	I 581
792	8.241 8065 603	790	8.242 0190 099	I 581
793	8.241 8064 813	791	8.242 0191 680	I 583
794	8.241 8064 022	792	8.242 0193 263	I 583
795	8.241 8063 230	792	8.242 0194 846	I 585
796	8.241 8062 438	792	8.242 0196 431	I 585
797	8.241 8061 646	793	8.242 0198 016	I 586
798	8.241 8060 853	793	8.242 0199 602	I 587
799	8.241 8060 060	793	8.242 0201 189	I 588
.800	8.241 8059 267		8.242 0202 777	
	S	d	T	d

1°	S	d	T	d
.800	8.241 8059 267	794	8.242 0202 777	1 588
801	8.241 8058 473	795	8.242 0204 365	1 590
802	8.241 8057 678	795	8.242 0205 955	1 590
803	8.241 8056 883	795	8.242 0207 545	1 592
804	8.241 8056 088	796	8.242 0209 137	1 592
805	8.241 8055 292	796	8.242 0210 729	1 593
806	8.241 8054 496	797	8.242 0212 322	1 594
807	8.241 8053 699	797	8.242 0213 916	1 595
808	8.241 8052 902	798	8.242 0215 511	1 596
809	8.241 8052 104	798	8.242 0217 107	1 596
.810	8.241 8051 306	798	8.242 0218 703	1 598
811	8.241 8050 508	799	8.242 0220 301	1 598
812	8.241 8049 709	799	8.242 0221 899	1 600
813	8.241 8048 910	800	8.242 0223 499	1 600
814	8.241 8048 110	800	8.242 0225 099	1 601
815	8.241 8047 310	801	8.242 0226 700	1 602
816	8.241 8046 509	801	8.242 0228 302	1 603
817	8.241 8045 708	801	8.242 0229 905	1 603
818	8.241 8044 907	802	8.242 0231 508	1 605
819	8.241 8044 105	803	8.242 0233 113	1 605
.820	8.241 8043 302	803	8.242 0234 718	1 607
821	8.241 8042 499	803	8.242 0236 325	1 607
822	8.241 8041 696	804	8.242 0237 932	1 608
823	8.241 8040 892	804	8.242 0239 540	1 609
824	8.241 8040 088	805	8.242 0241 149	1 610
825	8.241 8039 283	805	8.242 0242 759	1 611
826	8.241 8038 478	805	8.242 0244 370	1 611
827	8.241 8037 673	806	8.242 0245 981	1 613
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829	8.241 8036 061	807	8.242 0249 207	1 615
.830	8.241 8035 254	808	8.242 0250 822	1 615
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832	8.241 8033 639	808	8.242 0254 053	1 617
833	8.241 8032 831	809	8.242 0255 670	1 618
834	8.241 8032 022	809	8.242 0257 288	1 619
835	8.241 8031 213	810	8.242 0258 907	1 619
836	8.241 8030 403	809	8.242 0260 526	1 621
837	8.241 8029 594	811	8.242 0262 147	1 621
838	8.241 8028 783	811	8.242 0263 768	1 622
839	8.241 8027 972	811	8.242 0265 390	1 623
.840	8.241 8027 161	811	8.242 0267 013	1 624
841	8.241 8026 350	813	8.242 0268 637	1 625
842	8.241 8025 537	812	8.242 0270 262	1 626
843	8.241 8024 725	813	8.242 0271 888	1 627
844	8.241 8023 912	814	8.242 0273 515	1 627
845	8.241 8023 098	813	8.242 0275 142	1 629
846	8.241 8022 285	815	8.242 0276 771	1 629
847	8.241 8021 470	815	8.242 0278 400	1 630
848	8.241 8020 655	815	8.242 0280 030	1 631
849	8.241 8019 840	815	8.242 0281 661	1 632
.850	8.241 8019 025		8.242 0283 293	
	S	d	T	d

1°	S	d	T	d
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851	8.241 8018 208	816	8.242 0284 926	1 634
852	8.241 8017 392	817	8.242 0286 560	1 635
853	8.241 8016 575	817	8.242 0288 195	1 635
854	8.241 8015 758	818	8.242 0289 830	1 636
855	8.241 8014 940	819	8.242 0291 466	1 638
856	8.241 8014 121	818	8.242 0293 104	1 638
857	8.241 8013 303	819	8.242 0294 742	1 639
858	8.241 8012 484	820	8.242 0296 381	1 640
859	8.241 8011 664	820	8.242 0298 021	1 641
.860	8.241 8010 844	821	8.242 0299 662	1 641
861	8.241 8010 023	821	8.242 0301 303	1 643
862	8.241 8009 202	821	8.242 0302 946	1 643
863	8.241 8008 381	822	8.242 0304 589	1 645
864	8.241 8007 559	822	8.242 0306 234	1 645
865	8.241 8006 737	823	8.242 0307 879	1 646
866	8.241 8005 914	823	8.242 0309 525	1 647
867	8.241 8005 091	824	8.242 0311 172	1 648
868	8.241 8004 267	824	8.242 0312 820	1 649
869	8.241 8003 443	824	8.242 0314 469	1 649
.870	8.241 8002 619	825	8.242 0316 118	1 651
871	8.241 8001 794	825	8.242 0317 769	1 651
872	8.241 8000 969	826	8.242 0319 420	1 653
873	8.241 8000 143	826	8.242 0321 073	1 653
874	8.241 7999 317	827	8.242 0322 726	1 654
875	8.241 7998 490	827	8.242 0324 380	1 655
876	8.241 7997 663	828	8.242 0326 035	1 656
877	8.241 7996 835	828	8.242 0327 691	1 656
878	8.241 7996 007	828	8.242 0329 347	1 658
879	8.241 7995 179	829	8.242 0331 005	1 658
.880	8.241 7994 350	829	8.242 0332 663	1 660
881	8.241 7993 521	830	8.242 0334 323	1 660
882	8.241 7992 691	830	8.242 0335 983	1 661
883	8.241 7991 861	831	8.242 0337 644	1 662
884	8.241 7991 030	831	8.242 0339 306	1 663
885	8.241 7990 199	831	8.242 0340 969	1 664
886	8.241 7989 368	832	8.242 0342 633	1 664
887	8.241 7988 536	833	8.242 0344 297	1 666
888	8.241 7987 703	833	8.242 0345 963	1 666
889	8.241 7986 870	833	8.242 0347 629	1 668
.890	8.241 7986 037	834	8.242 0349 297	1 668
891	8.241 7985 203	834	8.242 0350 965	1 669
892	8.241 7984 369	835	8.242 0352 634	1 670
893	8.241 7983 534	835	8.242 0354 304	1 671
894	8.241 7982 699	835	8.242 0355 975	1 671
895	8.241 7981 864	836	8.242 0357 646	1 673
896	8.241 7981 028	836	8.242 0359 319	1 674
897	8.241 7980 192	837	8.242 0360 993	1 674
898	8.241 7979 355	837	8.242 0362 667	1 675
899	8.241 7978 518	838	8.242 0364 342	1 676
.900	8.241 7977 680		8.242 0366 018	
	S	d	T	d

1°	S	d	T	d
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901	8.241 7976 842	839	8.242 0367 695	1 678
902	8.241 7976 003	839	8.242 0369 373	1 679
903	8.241 7975 164	839	8.242 0371 052	1 680
904	8.241 7974 325	840	8.242 0372 732	1 680
905	8.241 7973 485	841	8.242 0374 412	1 682
906	8.241 7972 644	840	8.242 0376 094	1 682
907	8.241 7971 804	842	8.242 0377 776	1 683
908	8.241 7970 962	841	8.242 0379 459	1 684
909	8.241 7970 121	842	8.242 0381 143	1 685
.910	8.241 7969 279	843	8.242 0382 828	1 686
911	8.241 7968 436	843	8.242 0384 514	1 687
912	8.241 7967 593	843	8.242 0386 201	1 687
913	8.241 7966 750	844	8.242 0387 888	1 689
914	8.241 7965 906	845	8.242 0389 577	1 689
915	8.241 7965 061	844	8.242 0391 266	1 691
916	8.241 7964 217	846	8.242 0392 957	1 691
917	8.241 7963 371	845	8.242 0394 648	1 692
918	8.241 7962 526	846	8.242 0396 340	1 693
919	8.241 7961 680	847	8.242 0398 033	1 694
.920	8.241 7960 833	847	8.242 0399 727	1 694
921	8.241 7959 986	847	8.242 0401 421	1 696
922	8.241 7959 139	848	8.242 0403 117	1 696
923	8.241 7958 291	848	8.242 0404 813	1 698
924	8.241 7957 443	849	8.242 0406 511	1 698
925	8.241 7956 594	849	8.242 0408 209	1 699
926	8.241 7955 745	850	8.242 0409 908	1 700
927	8.241 7954 895	850	8.242 0411 608	1 701
928	8.241 7954 045	850	8.242 0413 309	1 702
929	8.241 7953 195	851	8.242 0415 011	1 702
.930	8.241 7952 344	852	8.242 0416 713	1 704
931	8.241 7951 492	851	8.242 0418 417	1 704
932	8.241 7950 641	853	8.242 0420 121	1 705
933	8.241 7949 788	852	8.242 0421 826	1 707
934	8.241 7948 936	854	8.242 0423 533	1 707
935	8.241 7948 082	853	8.242 0425 240	1 708
936	8.241 7947 229	854	8.242 0426 948	1 708
937	8.241 7946 375	855	8.242 0428 656	1 710
938	8.241 7945 520	855	8.242 0430 366	1 711
939	8.241 7944 665	855	8.242 0432 077	1 711
.940	8.241 7943 810	856	8.242 0433 788	1 712
941	8.241 7942 954	856	8.242 0435 500	1 714
942	8.241 7942 098	857	8.242 0437 214	1 714
943	8.241 7941 241	857	8.242 0438 928	1 715
944	8.241 7940 384	857	8.242 0440 643	1 716
945	8.241 7939 527	858	8.242 0442 359	1 717
946	8.241 7938 669	859	8.242 0444 076	1 717
947	8.241 7937 810	859	8.242 0445 793	1 719
948	8.241 7936 951	859	8.242 0447 512	1 719
949	8.241 7936 092	860	8.242 0449 231	1 720
.950	8.241 7935 232		8.242 0450 951	
	S	d	T	d

1°	S	d	T	d
.950	8.241 7935 232	860	8.242 0450 951	1 722
951	8.241 7934 372	860	8.242 0452 673	1 722
952	8.241 7933 512	861	8.242 0454 395	1 723
953	8.241 7932 651	862	8.242 0456 118	1 724
954	8.241 7931 789	862	8.242 0457 842	1 724
955	8.241 7930 927	862	8.242 0459 566	1 726
956	8.241 7930 065	863	8.242 0461 292	1 726
957	8.241 7929 202	863	8.242 0463 018	1 728
958	8.241 7928 339	864	8.242 0464 746	1 728
959	8.241 7927 475	864	8.242 0466 474	1 729
.960	8.241 7926 611	865	8.242 0468 203	1 730
961	8.241 7925 746	865	8.242 0469 933	1 731
962	8.241 7924 881	866	8.242 0471 664	1 732
963	8.241 7924 015	865	8.242 0473 396	1 732
964	8.241 7923 150	867	8.242 0475 128	1 734
965	8.241 7922 283	867	8.242 0476 862	1 734
966	8.241 7921 416	867	8.242 0478 596	1 736
967	8.241 7920 549	868	8.242 0480 332	1 736
968	8.241 7919 681	868	8.242 0482 068	1 737
969	8.241 7918 813	868	8.242 0483 805	1 738
.970	8.241 7917 945	869	8.242 0485 543	1 739
971	8.241 7917 076	870	8.242 0487 282	1 740
972	8.241 7916 206	870	8.242 0489 022	1 740
973	8.241 7915 336	870	8.242 0490 762	1 742
974	8.241 7914 466	871	8.242 0492 504	1 742
975	8.241 7913 595	871	8.242 0494 246	1 743
976	8.241 7912 724	872	8.242 0495 989	1 745
977	8.241 7911 852	872	8.242 0497 734	1 745
978	8.241 7910 980	872	8.242 0499 479	1 746
979	8.241 7910 108	873	8.242 0501 225	1 746
.980	8.241 7909 235	874	8.242 0502 971	1 748
981	8.241 7908 361	874	8.242 0504 719	1 749
982	8.241 7907 487	874	8.242 0506 468	1 749
983	8.241 7906 613	875	8.242 0508 217	1 750
984	8.241 7905 738	875	8.242 0509 967	1 752
985	8.241 7904 863	875	8.242 0511 719	1 752
986	8.241 7903 988	877	8.242 0513 471	1 753
987	8.241 7903 111	876	8.242 0515 224	1 754
988	8.241 7902 235	877	8.242 0516 978	1 754
989	8.241 7901 358	877	8.242 0518 732	1 756
.990	8.241 7900 481	878	8.242 0520 488	1 757
991	8.241 7899 603	879	8.242 0522 245	1 757
992	8.241 7898 724	878	8.242 0524 002	1 758
993	8.241 7897 846	879	8.242 0525 760	1 759
994	8.241 7896 967	880	8.242 0527 519	1 761
995	8.241 7896 087	880	8.242 0529 280	1 760
996	8.241 7895 207	881	8.242 0531 040	1 762
997	8.241 7894 326	881	8.242 0532 802	1 763
998	8.241 7893 445	881	8.242 0534 565	1 764
999	8.241 7892 564	882	8.242 0536 329	1 764
*000	8.241 7891 682		8.242 0538 093	
	S	d	T	d

2°	S	d	T	d
.000	8.241 7891 682	882	8.242 0538 093	1 765
001	8.241 7890 800	883	8.242 0539 858	1 767
002	8.241 7889 917	883	8.242 0541 625	1 767
003	8.241 7889 034	883	8.242 0543 392	1 768
004	8.241 7888 151	884	8.242 0545 160	1 769
005	8.241 7887 267	885	8.242 0546 929	1 770
006	8.241 7886 382	885	8.242 0548 699	1 770
007	8.241 7885 497	885	8.242 0550 469	1 772
008	8.241 7884 612	886	8.242 0552 241	1 772
009	8.241 7883 726	886	8.242 0554 013	1 773
.010	8.241 7882 840	887	8.242 0555 786	1 775
011	8.241 7881 953	887	8.242 0557 561	1 775
012	8.241 7881 066	887	8.242 0559 336	1 776
013	8.241 7880 179	888	8.242 0561 112	1 777
014	8.241 7879 291	889	8.242 0562 889	1 777
015	8.241 7878 402	889	8.242 0564 666	1 779
016	8.241 7877 513	889	8.242 0566 445	1 779
017	8.241 7876 624	890	8.242 0568 224	1 781
018	8.241 7875 734	890	8.242 0570 005	1 781
019	8.241 7874 844	890	8.242 0571 786	1 782
.020	8.241 7873 954	892	8.242 0573 568	1 783
021	8.241 7873 062	891	8.242 0575 351	1 784
022	8.241 7872 171	892	8.242 0577 135	1 785
023	8.241 7871 279	892	8.242 0578 920	1 786
024	8.241 7870 387	893	8.242 0580 706	1 786
025	8.241 7869 494	894	8.242 0582 492	1 788
026	8.241 7868 600	893	8.242 0584 280	1 788
027	8.241 7867 707	894	8.242 0586 068	1 789
028	8.241 7866 813	895	8.242 0587 857	1 790
029	8.241 7865 918	895	8.242 0589 647	1 791
.030	8.241 7865 023	896	8.242 0591 438	1 792
031	8.241 7864 127	895	8.242 0593 230	1 793
032	8.241 7863 232	897	8.242 0595 023	1 793
033	8.241 7862 335	897	8.242 0596 816	1 795
034	8.241 7861 438	897	8.242 0598 611	1 795
035	8.241 7860 541	898	8.242 0600 406	1 797
036	8.241 7859 643	898	8.242 0602 203	1 797
037	8.241 7858 745	898	8.242 0604 000	1 798
038	8.241 7857 847	899	8.242 0605 798	1 799
039	8.241 7856 948	900	8.242 0607 597	1 800
.040	8.241 7856 048	900	8.242 0609 397	1 800
041	8.241 7855 148	900	8.242 0611 197	1 802
042	8.241 7854 248	901	8.242 0612 999	1 802
043	8.241 7853 347	901	8.242 0614 801	1 804
044	8.241 7852 446	902	8.242 0616 605	1 804
045	8.241 7851 544	902	8.242 0618 409	1 805
046	8.241 7850 642	902	8.242 0620 214	1 806
047	8.241 7849 740	903	8.242 0622 020	1 807
048	8.241 7848 837	904	8.242 0623 827	1 808
049	8.241 7847 933	904	8.242 0625 635	1 808
.050	8.241 7847 029		8.242 0627 443	
	S	d	T	d

2°	S	d	T	d
.050	8.241 7847 029	904	8.242 0627 443	1 810
051	8.241 7846 125	905	8.242 0629 253	1 810
052	8.241 7845 220	905	8.242 0631 063	1 812
053	8.241 7844 315	905	8.242 0632 875	1 812
054	8.241 7843 410	906	8.242 0634 687	1 813
055	8.241 7842 504	907	8.242 0636 500	1 814
056	8.241 7841 597	907	8.242 0638 314	1 815
057	8.241 7840 690	907	8.242 0640 129	1 815
058	8.241 7839 783	908	8.242 0641 944	1 817
059	8.241 7838 875	908	8.242 0643 761	1 818
.060	8.241 7837 967	909	8.242 0645 579	1 818
061	8.241 7837 058	909	8.242 0647 397	1 819
062	8.241 7836 149	910	8.242 0649 216	1 820
063	8.241 7835 239	910	8.242 0651 036	1 821
064	8.241 7834 329	910	8.242 0652 857	1 822
065	8.241 7833 419	911	8.242 0654 679	1 823
066	8.241 7832 508	912	8.242 0656 502	1 824
067	8.241 7831 596	911	8.242 0658 326	1 824
068	8.241 7830 685	913	8.242 0660 150	1 826
069	8.241 7829 772	912	8.242 0661 976	1 826
.070	8.241 7828 860	914	8.242 0663 802	1 827
071	8.241 7827 946	913	8.242 0665 629	1 828
072	8.241 7827 033	914	8.242 0667 457	1 829
073	8.241 7826 119	915	8.242 0669 286	1 830
074	8.241 7825 204	914	8.242 0671 116	1 831
075	8.241 7824 290	916	8.242 0672 947	1 832
076	8.241 7823 374	916	8.242 0674 779	1 832
077	8.241 7822 458	916	8.242 0676 611	1 833
078	8.241 7821 542	916	8.242 0678 444	1 835
079	8.241 7820 626	918	8.242 0680 279	1 835
.080	8.241 7819 708	917	8.242 0682 114	1 836
081	8.241 7818 791	918	8.242 0683 950	1 837
082	8.241 7817 873	918	8.242 0685 787	1 838
083	8.241 7816 955	919	8.242 0687 625	1 838
084	8.241 7816 036	920	8.242 0689 463	1 840
085	8.241 7815 116	919	8.242 0691 303	1 840
086	8.241 7814 197	921	8.242 0693 143	1 842
087	8.241 7813 276	920	8.242 0694 985	1 842
088	8.241 7812 356	921	8.242 0696 827	1 843
089	8.241 7811 435	922	8.242 0698 670	1 844
.090	8.241 7810 513	922	8.242 0700 514	1 845
091	8.241 7809 591	922	8.242 0702 359	1 846
092	8.241 7808 669	923	8.242 0704 205	1 846
093	8.241 7807 746	923	8.242 0706 051	1 848
094	8.241 7806 823	924	8.242 0707 899	1 848
095	8.241 7805 899	924	8.242 0709 747	1 850
096	8.241 7804 975	925	8.242 0711 597	1 850
097	8.241 7804 050	925	8.242 0713 447	1 851
098	8.241 7803 125	925	8.242 0715 298	1 852
099	8.241 7802 200	926	8.242 0717 150	1 853
.100	8.241 7801 274		8.242 0719 003	
	S	d	T	d

Verwandlungstafeln

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Beispiele

1) 4.13 56 92 74 829 in Gradmaß zu verwandeln.

4.0	=	229.°183 118 052
0.13	=	7.448 451 337
0.00 56	=	0.320 856 365
0.00 00 92	=	0.005 271 212
0.00 00 00 74	=	0.000 042 399
0.00 00 00 00 829	=	0.000 000 475
4.13 56 92 74 829	=	236.°957 739 840

2) 236.°95 77 39 840 in Bogenmaß zu verwandeln.

236°	=	4.118 9770 347 1
0.95	=	0.016 5806 278 9
0.00 77	=	0.000 1343 903 5
0.00 00 39	=	0.000 0006 806 8
0.00 00 00 840	=	0.000 0000 146 6
236.°95 77 39 840	=	4.135 6927 482 9

3) 57′ 27.″86 34 2 in Bruchteile des Grades zu verwandeln.

57′	=	0.°950 000 000
27″	=	0.007 500 000
0.86	=	0.000 238 889
0.00 34	=	0.000 000 944
0.00 00 2	=	0.000 000 006
57′ 27.″86 34 2	=	0.°957 739 839

4) 0.°95 77 39 84 in Bogen-Minuten und -Sekunden zu verwandeln.

0.°95	=	57′ 0″
0.00 77	=	27.72
0.00 00 39	=	0.14 04
0.00 00 00 84	=	0.00 30 2
0.°95 77 39 84	=	57′ 27.″86 34 2

5) 15h 47m 49.s85 75 62 in Gradmaß zu verwandeln.

15h	=	225°
47m	=	11.75
49s	=	0.204 166 667
0.85	=	0.003 541 667
0.00 75	=	0.000 031 250
0.00 00 62	=	0.000 000 258
15h 47m 49.s85 75 62	=	236.°957 739 842

6) 236.°95 77 39 84 in Zeitmaß zu verwandeln.

236°	=	15h 44m
0.95	=	3s 48.0
0.00 77	=	1.84 8
0.00 00 39	=	0.00 93 6
0.00 00 00 84	=	0.00 02 02
236.°95 77 39 84	=	15h 47m 49.s85 75 62

7) 185.g279 368 154 in altes Gradmaß zu verwandeln.

185g	=	166.°5
0.27	=	0.243
0.00 93	=	0.008 37
0.00 00 68	=	0.000 061 2
0.00 00 00 154	=	0.000 000 139
185.g27 93 68 154	=	166.°751 431 339

8) 166.°751 431 339 in neues Gradmaß zu verwandeln.

166°	=	184.g444 444 444
0.75	=	0.833 333 333
0.00 14	=	0.001 555 556
0.00 00 31	=	0.000 034 444
0.00 00 00 339	=	0.000 000 377
166.°75 14 31 339	=	185.g279 368 154

Verwandlung von Bogenmaß in Gradmaß

Transformation

1.	57.295 779 513	4.	229.183 118 052
2.	114.591 559 026	5.	286.478 897 565
3.	171.887 338 539	6.	343.774 677 078

0.00	0.000 000 000	0.50	28.647 889 757
01	0.572 957 795	51	29.220 847 552
02	1.145 915 590	52	29.793 805 347
03	1.718 873 385	53	30.366 763 142
04	2.291 831 181	54	30.939 720 937
05	2.864 788 976	55	31.512 678 732
06	3.437 746 771	56	32.085 636 527
07	4.010 704 566	57	32.658 594 322
08	4.583 662 361	58	33.231 552 118
09	5.156 620 156	59	33.804 509 913
0.10	5.729 577 951	0.60	34.377 467 708
11	6.302 535 746	61	34.950 425 503
12	6.875 493 542	62	35.523 383 298
13	7.448 451 337	63	36.096 341 093
14	8.021 409 132	64	36.669 298 888
15	8.594 366 927	65	37.242 256 684
16	9.167 324 722	66	37.815 214 479
17	9.740 282 517	67	38.388 172 274
18	10.313 240 312	68	38.961 130 069
19	10.886 198 107	69	39.534 087 864
0.20	11.459 155 903	0.70	40.107 045 659
21	12.032 113 698	71	40.680 003 454
22	12.605 071 493	72	41.252 961 249
23	13.178 029 288	73	41.825 919 045
24	13.750 987 083	74	42.398 876 840
25	14.323 944 878	75	42.971 834 635
26	14.896 902 673	76	43.544 792 430
27	15.469 860 469	77	44.117 750 225
28	16.042 818 264	78	44.690 708 020
29	16.615 776 059	79	45.263 665 815
0.30	17.188 733 854	0.80	45.836 623 610
31	17.761 691 649	81	46.409 581 406
32	18.334 649 444	82	46.982 539 201
33	18.907 607 239	83	47.555 496 996
34	19.480 565 034	84	48.128 454 791
35	20.053 522 830	85	48.701 412 586
36	20.626 480 625	86	49.274 370 381
37	21.199 438 420	87	49.847 328 176
38	21.772 396 215	88	50.420 285 972
39	22.345 354 010	89	50.993 243 767
0.40	22.918 311 805	0.90	51.566 201 562
41	23.491 269 600	91	52.139 159 357
42	24.064 227 395	92	52.712 117 152
43	24.637 185 191	93	53.285 074 947
44	25.210 142 986	94	53.858 032 742
45	25.783 100 781	95	54.430 990 537
46	26.356 058 576	96	55.003 948 333
47	26.929 016 371	97	55.576 906 128
48	27.501 974 166	98	56.149 863 923
49	28.074 931 961	99	56.722 821 718

0.00 00	0.000 000 000	0.00 50	0.286 478 898
01	0.005 729 578	51	0.292 208 476
02	0.011 459 156	52	0.297 938 053
03	0.017 188 734	53	0.303 667 631
04	0.022 918 312	54	0.309 397 209
05	0.028 647 890	55	0.315 126 787
06	0.034 377 468	56	0.320 856 365
07	0.040 107 046	57	0.326 585 943
08	0.045 836 624	58	0.332 315 521
09	0.051 566 202	59	0.338 045 099
0.00 10	0.057 295 780	0.00 60	0.343 774 677
11	0.063 025 357	61	0.349 504 255
12	0.068 754 935	62	0.355 233 833
13	0.074 484 513	63	0.360 963 411
14	0.080 214 091	64	0.366 692 989
15	0.085 943 669	65	0.372 422 567
16	0.091 673 247	66	0.378 152 145
17	0.097 402 825	67	0.383 881 723
18	0.103 132 403	68	0.389 611 301
19	0.108 861 981	69	0.395 340 879
0.00 20	0.114 591 559	0.00 70	0.401 070 457
21	0.120 321 137	71	0.406 800 035
22	0.126 050 715	72	0.412 529 612
23	0.131 780 293	73	0.418 259 190
24	0.137 509 871	74	0.423 988 768
25	0.143 239 449	75	0.429 718 346
26	0.148 969 027	76	0.435 447 924
27	0.154 698 605	77	0.441 177 502
28	0.160 428 183	78	0.446 907 080
29	0.166 157 761	79	0.452 636 658
0.00 30	0.171 887 339	0.00 80	0.458 366 236
31	0.177 616 916	81	0.464 095 814
32	0.183 346 494	82	0.469 825 392
33	0.189 076 072	83	0.475 554 970
34	0.194 805 650	84	0.481 284 548
35	0.200 535 228	85	0.487 014 126
36	0.206 264 806	86	0.492 743 704
37	0.211 994 384	87	0.498 473 282
38	0.217 723 962	88	0.504 202 860
39	0.223 453 540	89	0.509 932 438
0.00 40	0.229 183 118	0.00 90	0.515 662 016
41	0.234 912 696	91	0.521 391 594
42	0.240 642 274	92	0.527 121 172
43	0.246 371 852	93	0.532 850 749
44	0.252 101 430	94	0.538 580 327
45	0.257 831 008	95	0.544 309 905
46	0.263 560 586	96	0.550 039 483
47	0.269 290 164	97	0.555 769 061
48	0.275 019 742	98	0.561 498 639
49	0.280 749 320	99	0.567 228 217

Bogen	°	Bogen	°
0.00 00 00	0.000 000 000	0.00 00 50	0.002 864 789
01	0.000 057 296	51	0.002 922 085
02	0.000 114 592	52	0.002 979 381
03	0.000 171 887	53	0.003 036 676
04	0.000 229 183	54	0.003 093 972
05	0.000 286 479	55	0.003 151 268
06	0.000 343 775	56	0.003 208 564
07	0.000 401 070	57	0.003 265 859
08	0.000 458 366	58	0.003 323 155
09	0.000 515 662	59	0.003 380 451
0.00 00 10	0.000 572 958	0.00 00 60	0.003 437 747
11	0.000 630 254	61	0.003 495 043
12	0.000 687 549	62	0.003 552 338
13	0.000 744 845	63	0.003 609 634
14	0.000 802 141	64	0.003 666 930
15	0.000 859 437	65	0.003 724 226
16	0.000 916 732	66	0.003 781 521
17	0.000 974 028	67	0.003 838 817
18	0.001 031 324	68	0.003 896 113
19	0.001 088 620	69	0.003 953 409
0.00 00 20	0.001 145 916	0.00 00 70	0.004 010 705
21	0.001 203 211	71	0.004 068 000
22	0.001 260 507	72	0.004 125 296
23	0.001 317 803	73	0.004 182 592
24	0.001 375 099	74	0.004 239 888
25	0.001 432 394	75	0.004 297 183
26	0.001 489 690	76	0.004 354 479
27	0.001 546 986	77	0.004 411 775
28	0.001 604 282	78	0.004 469 071
29	0.001 661 578	79	0.004 526 367
0.00 00 30	0.001 718 873	0.00 00 80	0.004 583 662
31	0.001 776 169	81	0.004 640 958
32	0.001 833 465	82	0.004 698 254
33	0.001 890 761	83	0.004 755 550
34	0.001 948 057	84	0.004 812 845
35	0.002 005 352	85	0.004 870 141
36	0.002 062 648	86	0.004 927 437
37	0.002 119 944	87	0.004 984 733
38	0.002 177 240	88	0.005 042 029
39	0.002 234 535	89	0.005 099 324
0.00 00 40	0.002 291 831	0.00 00 90	0.005 156 620
41	0.002 349 127	91	0.005 213 916
42	0.002 406 423	92	0.005 271 212
43	0.002 463 719	93	0.005 328 507
44	0.002 521 014	94	0.005 385 803
45	0.002 578 310	95	0.005 443 099
46	0.002 635 606	96	0.005 500 395
47	0.002 692 902	97	0.005 557 691
48	0.002 750 197	98	0.005 614 986
49	0.002 807 493	99	0.005 672 282
Bogen		Bogen	

Bogen	°	Bogen	‘‘
0.00 00 00 00	0.000 000 000	0.00 00 00 50	0.000 028 648
01	0.000 000 573	51	0.000 029 221
02	0.000 001 146	52	0.000 029 794
03	0.000 001 719	53	0.000 030 367
04	0.000 002 292	54	0.000 030 940
05	0.000 002 865	55	0.000 031 513
06	0.000 003 438	56	0.000 032 086
07	0.000 004 011	57	0.000 032 659
08	0.000 004 584	58	0.000 033 232
09	0.000 005 157	59	0.000 033 805
0.00 00 00 10	0.000 005 730	0.00 00 00 60	0.000 034 377
11	0.000 006 303	61	0.000 034 950
12	0.000 006 875	62	0.000 035 523
13	0.000 007 448	63	0.000 036 096
14	0.000 008 021	64	0.000 036 669
15	0.000 008 594	65	0.000 037 242
16	0.000 009 167	66	0.000 037 815
17	0.000 009 740	67	0.000 038 388
18	0.000 010 313	68	0.000 038 961
19	0.000 010 886	69	0.000 039 534
0.00 00 00 20	0.000 011 459	0.00 00 00 70	0.000 040 107
21	0.000 012 032	71	0.000 040 680
22	0.000 012 605	72	0.000 041 253
23	0.000 013 178	73	0.000 041 826
24	0.000 013 751	74	0.000 042 399
25	0.000 014 324	75	0.000 042 972
26	0.000 014 897	76	0.000 043 545
27	0.000 015 470	77	0.000 044 118
28	0.000 016 043	78	0.000 044 691
29	0.000 016 616	79	0.000 045 264
0.00 00 00 30	0.000 017 189	0.00 00 00 80	0.000 045 837
31	0.000 017 762	81	0.000 046 410
32	0.000 018 335	82	0.000 046 983
33	0.000 018 908	83	0.000 047 555
34	0.000 019 481	84	0.000 048 128
35	0.000 020 054	85	0.000 048 701
36	0.000 020 626	86	0.000 049 274
37	0.000 021 199	87	0.000 049 847
38	0.000 021 772	88	0.000 050 420
39	0.000 022 345	89	0.000 050 993
0.00 00 00 40	0.000 022 918	0.00 00 00 90	0.000 051 566
41	0.000 023 491	91	0.000 052 139
42	0.000 024 064	92	0.000 052 712
43	0.000 024 637	93	0.000 053 285
44	0.000 025 210	94	0.000 053 858
45	0.000 025 783	95	0.000 054 431
46	0.000 026 356	96	0.000 055 004
47	0.000 026 929	97	0.000 055 577
48	0.000 027 502	98	0.000 056 150
49	0.000 028 075	99	0.000 056 723
Bogen		Bogen	

Bogen	°	Bogen	°
0.00 00 00 00 00	0.000 000 000	0.00 00 00 00 50	0.000 000 286
01	0.000 000 006	51	0.000 000 292
02	0.000 000 011	52	0.000 000 298
03	0.000 000 017	53	0.000 000 304
04	0.000 000 023	54	0.000 000 309
05	0.000 000 029	55	0.000 000 315
06	0.000 000 034	56	0.000 000 321
07	0.000 000 040	57	0.000 000 327
08	0.000 000 046	58	0.000 000 332
09	0.000 000 052	59	0.000 000 338
0.00 00 00 00 10	0.000 000 057	0.00 00 00 00 60	0.000 000 344
11	0.000 000 063	61	0.000 000 350
12	0.000 000 069	62	0.000 000 355
13	0.000 000 074	63	0.000 000 361
14	0.000 000 080	64	0.000 000 367
15	0.000 000 086	65	0.000 000 372
16	0.000 000 092	66	0.000 000 378
17	0.000 000 097	67	0.000 000 384
18	0.000 000 103	68	0.000 000 390
19	0.000 000 109	69	0.000 000 395
0.00 00 00 00 20	0.000 000 115	0.00 00 00 00 70	0.000 000 401
21	0.000 000 120	71	0.000 000 407
22	0.000 000 126	72	0.000 000 413
23	0.000 000 132	73	0.000 000 418
24	0.000 000 138	74	0.000 000 424
25	0.000 000 143	75	0.000 000 430
26	0.000 000 149	76	0.000 000 435
27	0.000 000 155	77	0.000 000 441
28	0.000 000 160	78	0.000 000 447
29	0.000 000 166	79	0.000 000 453
0.00 00 00 00 30	0.000 000 172	0.00 00 00 00 80	0.000 000 458
31	0.000 000 178	81	0.000 000 464
32	0.000 000 183	82	0.000 000 470
33	0.000 000 189	83	0.000 000 476
34	0.000 000 195	84	0.000 000 481
35	0.000 000 201	85	0.000 000 487
36	0.000 000 206	86	0.000 000 493
37	0.000 000 212	87	0.000 000 498
38	0.000 000 218	88	0.000 000 504
39	0.000 000 223	89	0.000 000 510
0.00 00 00 00 40	0.000 000 229	0.00 00 00 00 90	0.000 000 516
41	0.000 000 235	91	0.000 000 521
42	0.000 000 241	92	0.000 000 527
43	0.000 000 246	93	0.000 000 533
44	0.000 000 252	94	0.000 000 539
45	0.000 000 258	95	0.000 000 544
46	0.000 000 264	96	0.000 000 550
47	0.000 000 269	97	0.000 000 556
48	0.000 000 275	98	0.000 000 561
49	0.000 000 281	99	0.000 000 567
Bogen		Bogen	

°					°					°				
0	0.000	0000	000	0	60	1.047	1975	512	0	120	2.094	3951	023	9
1	0.017	4532	925	2	61	1.064	6508	437	2	121	2.111	8483	949	1
2	0.034	9065	850	4	62	1.082	1041	362	4	122	2.129	3016	874	3
3	0.052	3598	775	6	63	1.099	5574	287	6	123	2.146	7549	799	5
4	0.069	8131	700	8	64	1.117	0107	212	8	124	2.164	2082	724	7
5	0.087	2664	626	0	65	1.134	4640	138	0	125	2.181	6615	649	9
6	0.104	7197	551	2	66	1.151	9173	063	2	126	2.199	1148	575	1
7	0.122	1730	476	4	67	1.169	3705	988	4	127	2.216	5681	500	3
8	0.139	6263	401	6	68	1.186	8238	913	6	128	2.234	0214	425	5
9	0.157	0796	326	8	69	1.204	2771	838	8	129	2.251	4747	350	7
10	0.174	5329	252	0	70	1.221	7304	764	0	130	2.268	9280	275	9
11	0.191	9862	177	2	71	1.239	1837	689	2	131	2.286	3813	201	1
12	0.209	4395	102	4	72	1.256	6370	614	4	132	2.303	8346	126	3
13	0.226	8928	027	6	73	1.274	0903	539	6	133	2.321	2879	051	5
14	0.244	3460	952	8	74	1.291	5436	464	8	134	2.338	7411	976	7
15	0.261	7993	878	0	75	1.308	9969	390	0	135	2.356	1944	901	9
16	0.279	2526	803	2	76	1.326	4502	315	2	136	2.373	6477	827	1
17	0.296	7059	728	4	77	1.343	9035	240	4	137	2.391	1010	752	3
18	0.314	1592	653	6	78	1.361	3568	165	6	138	2.408	5543	677	5
19	0.331	6125	578	8	79	1.378	8101	090	8	139	2.426	0076	602	7
20	0.349	0658	504	0	80	1.396	2634	016	0	140	2.443	4609	527	9
21	0.366	5191	429	2	81	1.413	7166	941	2	141	2.460	9142	453	1
22	0.383	9724	354	4	82	1.431	1699	866	4	142	2.478	3675	378	3
23	0.401	4257	279	6	83	1.448	6232	791	6	143	2.495	8208	303	5
24	0.418	8790	204	8	84	1.466	0765	716	8	144	2.513	2741	228	7
25	0.436	3323	130	0	85	1.483	5298	642	0	145	2.530	7274	153	9
26	0.453	7856	055	2	86	1.500	9831	567	2	146	2.548	1807	079	1
27	0.471	2388	980	4	87	1.518	4364	492	4	147	2.565	6340	004	3
28	0.488	6921	905	6	88	1.535	8897	417	6	148	2.583	0872	929	5
29	0.506	1454	830	8	89	1.553	3430	342	7	149	2.600	5405	854	7
30	0.523	5987	756	0	90	1.570	7963	267	9	150	2.617	9938	779	9
31	0.541	0520	681	2	91	1.588	2496	193	1	151	2.635	4471	705	1
32	0.558	5053	606	4	92	1.605	7029	118	3	152	2.652	9004	630	3
33	0.575	9586	531	6	93	1.623	1562	043	5	153	2.670	3537	555	5
34	0.593	4119	456	8	94	1.640	6094	968	7	154	2.687	8070	480	7
35	0.610	8652	382	0	95	1.658	0627	893	9	155	2.705	2603	405	9
36	0.628	3185	307	2	96	1.675	5160	819	1	156	2.722	7136	331	1
37	0.645	7718	232	4	97	1.692	9693	744	3	157	2.740	1669	256	3
38	0.663	2251	157	6	98	1.710	4226	669	5	158	2.757	6202	181	5
39	0.680	6784	082	8	99	1.727	8759	594	7	159	2.775	0735	106	7
40	0.698	1317	008	0	100	1.745	3292	519	9	160	2.792	5268	031	9
41	0.715	5849	933	2	101	1.762	7825	445	1	161	2.809	9800	957	1
42	0.733	0382	858	4	102	1.780	2358	370	3	162	2.827	4333	882	3
43	0.750	4915	783	6	103	1.797	6891	295	5	163	2.844	8866	807	5
44	0.767	9448	708	8	104	1.815	1424	220	7	164	2.862	3399	732	7
45	0.785	3981	634	0	105	1.832	5957	145	9	165	2.879	7932	657	9
46	0.802	8514	559	2	106	1.850	0490	071	1	166	2.897	2465	583	1
47	0.820	3047	484	4	107	1.867	5022	996	3	167	2.914	6998	508	3
48	0.837	7580	409	6	108	1.884	9555	921	5	168	2.932	1531	433	5
49	0.855	2113	334	8	109	1.902	4088	846	7	169	2.949	6064	358	7
50	0.872	6646	260	0	110	1.919	8621	771	9	170	2.967	0597	283	9
51	0.890	1179	185	2	111	1.937	3154	697	1	171	2.984	5130	209	1
52	0.907	5712	110	4	112	1.954	7687	622	3	172	3.001	9663	134	3
53	0.925	0245	035	6	113	1.972	2220	547	5	173	3.019	4196	059	5
54	0.942	4777	960	8	114	1.989	6753	472	7	174	3.036	8728	984	7
55	0.959	9310	886	0	115	2.007	1286	397	9	175	3.054	3261	909	9
56	0.977	3843	811	2	116	2.024	5819	323	1	176	3.071	7794	835	1
57	0.994	8376	736	4	117	2.042	0352	248	3	177	3.089	2327	760	3
58	1.012	2909	661	6	118	2.059	4885	173	5	178	3.106	6860	685	5
59	1.029	7442	586	8	119	2.076	9418	098	7	179	3.124	1393	610	7

Gradmaß in Bogenmaß

180°	3.141	5926	535	9	240°	4.188	7902	047	9	300°	5.235	9877	559	8
181	3.159	0459	461	1	241	4.206	2434	973	1	301	5.253	4410	485	0
182	3.176	4992	386	3	242	4.223	6967	898	3	302	5.270	8943	410	2
183	3.193	9525	311	5	243	4.241	1500	823	5	303	5.288	3476	335	4
184	3.211	4058	236	7	244	4.258	6033	748	7	304	5.305	8009	260	6
185	3.228	8591	161	9	245	4.276	0566	673	9	305	5.323	2542	185	8
186	3.246	3124	087	1	246	4.293	5099	599	1	306	5.340	7075	111	0
187	3.263	7657	012	3	247	4.310	9632	524	3	307	5.358	1608	036	2
188	3.281	2189	937	5	248	4.328	4165	449	5	308	5.375	6140	961	4
189	3.298	6722	862	7	249	4.345	8698	374	7	309	5.393	0673	886	6
190	3.316	1255	787	9	250	4.363	3231	299	9	310	5.410	5206	811	8
191	3.333	5788	713	1	251	4.380	7764	225	1	311	5.427	9739	737	0
192	3.351	0321	638	3	252	4.398	2297	150	3	312	5.445	4272	662	2
193	3.368	4854	563	5	253	4.415	6830	075	5	313	5.462	8805	587	4
194	3.385	9387	488	7	254	4.433	1363	000	7	314	5.480	3338	512	6
195	3.403	3920	413	9	255	4.450	5895	925	9	315	5.497	7871	437	8
196	3.420	8453	339	1	256	4.468	0428	851	1	316	5.515	2404	363	0
197	3.438	2986	264	3	257	4.485	4961	776	3	317	5.532	6937	288	2
198	3.455	7519	189	5	258	4.502	9494	701	5	318	5.550	1470	213	4
199	3.473	2052	114	7	259	4.520	4027	626	7	319	5.567	6003	138	6
200	3.490	6585	039	9	260	4.537	8560	551	9	320	5.585	0536	063	8
201	3.508	1117	965	1	261	4.555	3093	477	1	321	5.602	5068	989	0
202	3.525	5650	890	3	262	4.572	7626	402	3	322	5.619	9601	914	2
203	3.543	0183	815	5	263	4.590	2159	327	5	323	5.637	4134	839	4
204	3.560	4716	740	7	264	4.607	6692	252	7	324	5.654	8667	764	6
205	3.577	9249	665	9	265	4.625	1225	177	8	325	5.672	3200	689	8
206	3.595	3782	591	1	266	4.642	5758	103	0	326	5.689	7733	615	0
207	3.612	8315	516	3	267	4.660	0291	028	2	327	5.707	2266	540	2
208	3.630	2848	441	5	268	4.677	4823	953	4	328	5.724	6799	465	4
209	3.647	7381	366	7	269	4.694	9356	878	6	329	5.742	1332	390	6
210	3.665	1914	291	9	270	4.712	3889	803	8	330	5.759	5865	315	8
211	3.682	6447	217	1	271	4.729	8422	729	0	331	5.777	0398	241	0
212	3.700	0980	142	3	272	4.747	2955	654	2	332	5.794	4931	166	2
213	3.717	5513	067	5	273	4.764	7488	579	4	333	5.811	9464	091	4
214	3.735	0045	992	7	274	4.782	2021	504	6	334	5.829	3997	016	6
215	3.752	4578	917	9	275	4.799	6554	429	8	335	5.846	8529	941	8
216	3.769	9111	843	1	276	4.817	1087	355	0	336	5.864	3062	867	0
217	3.787	3644	768	3	277	4.834	5620	280	2	337	5.881	7595	792	2
218	3.804	8177	693	5	278	4.852	0153	205	4	338	5.899	2128	717	4
219	3.822	2710	618	7	279	4.869	4686	130	6	339	5.916	6661	642	6
220	3.839	7243	543	9	280	4.886	9219	055	8	340	5.934	1194	567	8
221	3.857	1776	469	1	281	4.904	3751	981	0	341	5.951	5727	493	0
222	3.874	6309	394	3	282	4.921	8284	906	2	342	5.969	0260	418	2
223	3.892	0842	319	5	283	4.939	2817	831	4	343	5.986	4793	343	4
224	3.909	5375	244	7	284	4.956	7350	756	6	344	6.003	9326	268	6
225	3.926	9908	169	9	285	4.974	1883	681	8	345	6.021	3859	193	8
226	3.944	4441	095	1	286	4.991	6416	607	0	346	6.038	8392	119	0
227	3.961	8974	020	3	287	5.009	0949	532	2	347	6.056	2925	044	2
228	3.979	3506	945	5	288	5.026	5482	457	4	348	6.073	7457	969	4
229	3.996	8039	870	7	289	5.044	0015	382	6	349	6.091	1990	894	6
230	4.014	2572	795	9	290	5.061	4548	307	8	350	6.108	6523	819	8
231	4.031	7105	721	1	291	5.078	9081	233	0	351	6.126	1056	745	0
232	4.049	1638	646	3	292	5.096	3614	158	2	352	6.143	5589	670	2
233	4.066	6171	571	5	293	5.113	8147	083	4	353	6.161	0122	595	4
234	4.084	0704	496	7	294	5.131	2680	008	6	354	6.178	4655	520	6
235	4.101	5237	421	9	295	5.148	7212	933	8	355	6.195	9188	445	8
236	4.118	9770	347	1	296	5.166	1745	859	0	356	6.213	3721	371	0
237	4.136	4303	272	3	297	5.183	6278	784	2	357	6.230	8254	296	2
238	4.153	8836	197	5	298	5.201	0811	709	4	358	6.248	2787	221	4
239	4.171	3369	122	7	299	5.218	5344	634	6	359	6.265	7320	146	6

	Bogen		Bogen
°		°	
0.00	0.000 0000 000 0	0.50	0.008 7266 462 6
01	0.000 1745 329 3	51	0.008 9011 791 9
02	0.000 3490 658 5	52	0.009 0757 121 1
03	0.000 5235 987 8	53	0.009 2502 450 4
04	0.000 6981 317 0	54	0.009 4247 779 6
05	0.000 8726 646 3	55	0.009 5993 108 9
06	0.001 0471 975 5	56	0.009 7738 438 1
07	0.001 2217 304 8	57	0.009 9483 767 4
08	0.001 3962 634 0	58	0.010 1229 096 6
09	0.001 5707 963 3	59	0.010 2974 425 9
0.10	0.001 7453 292 5	0.60	0.010 4719 755 1
11	0.001 9198 621 8	61	0.010 6465 084 4
12	0.002 0943 951 0	62	0.010 8210 413 6
13	0.002 2689 280 3	63	0.010 9955 742 9
14	0.002 4434 609 5	64	0.011 1701 072 1
15	0.002 6179 938 8	65	0.011 3446 401 4
16	0.002 7925 268 0	66	0.011 5191 730 6
17	0.002 9670 597 3	67	0.011 6937 059 9
18	0.003 1415 926 5	68	0.011 8682 389 1
19	0.003 3161 255 8	69	0.012 0427 718 4
0.20	0.003 4906 585 0	0.70	0.012 2173 047 6
21	0.003 6651 914 3	71	0.012 3918 376 9
22	0.003 8397 243 5	72	0.012 5663 706 1
23	0.004 0142 572 8	73	0.012 7409 035 4
24	0.004 1887 902 0	74	0.012 9154 364 6
25	0.004 3633 231 3	75	0.013 0899 693 9
26	0.004 5378 560 6	76	0.013 2645 023 2
27	0.004 7123 889 8	77	0.013 4390 352 4
28	0.004 8869 219 1	78	0.013 6135 681 7
29	0.005 0614 548 3	79	0.013 7881 010 9
0.30	0.005 2359 877 6	0.80	0.013 9626 340 2
31	0.005 4105 206 8	81	0.014 1371 669 4
32	0.005 5850 536 1	82	0.014 3116 998 7
33	0.005 7595 865 3	83	0.014 4862 327 9
34	0.005 9341 194 6	84	0.014 6607 657 2
35	0.006 1086 523 8	85	0.014 8352 986 4
36	0.006 2831 853 1	86	0.015 0098 315 7
37	0.006 4577 182 3	87	0.015 1843 644 9
38	0.006 6322 511 6	88	0.015 3588 974 2
39	0.006 8067 840 8	89	0.015 5334 303 4
0.40	0.006 9813 170 1	0.90	0.015 7079 632 7
41	0.007 1558 499 3	91	0.015 8824 961 9
42	0.007 3303 828 6	92	0.016 0570 291 2
43	0.007 5049 157 8	93	0.016 2315 620 4
44	0.007 6794 487 1	94	0.016 4060 949 7
45	0.007 8539 816 3	95	0.016 5806 278 9
46	0.008 0285 145 6	96	0.016 7551 608 2
47	0.008 2030 474 8	97	0.016 9296 937 4
48	0.008 3775 804 1	98	0.017 1042 266 7
49	0.008 5521 133 3	99	0.017 2787 595 9
	Bogen		Bogen

	Bogen		Bogen
°		°	
0.00 00	0.000 0000 000 0	0.00 50	0.000 0872 664 6
01	0.000 0017 453 3	51	0.000 0890 117 9
02	0.000 0034 906 6	52	0.000 0907 571 2
03	0.000 0052 359 9	53	0.000 0925 024 5
04	0.000 0069 813 2	54	0.000 0942 477 8
05	0.000 0087 266 5	55	0.000 0959 931 1
06	0.000 0104 719 8	56	0.000 0977 384 4
07	0.000 0122 173 0	57	0.000 0994 837 7
08	0.000 0139 626 3	58	0.000 1012 291 0
09	0.000 0157 079 6	59	0.000 1029 744 3
0.00 10	0.000 0174 532 9	0.00 60	0.000 1047 197 6
11	0.000 0191 986 2	61	0.000 1064 650 8
12	0.000 0209 439 5	62	0.000 1082 104 1
13	0.000 0226 892 8	63	0.000 1099 557 4
14	0.000 0244 346 1	64	0.000 1117 010 7
15	0.000 0261 799 4	65	0.000 1134 464 0
16	0.000 0279 252 7	66	0.000 1151 917 3
17	0.000 0296 706 0	67	0.000 1169 370 6
18	0.000 0314 159 3	68	0.000 1186 823 9
19	0.000 0331 612 6	69	0.000 1204 277 2
0.00 20	0.000 0349 065 9	0.00 70	0.000 1221 730 5
21	0.000 0366 519 1	71	0.000 1239 183 8
22	0.000 0383 972 4	72	0.000 1256 637 1
23	0.000 0401 425 7	73	0.000 1274 090 4
24	0.000 0418 879 0	74	0.000 1291 543 6
25	0.000 0436 332 3	75	0.000 1308 996 9
26	0.000 0453 785 6	76	0.000 1326 450 2
27	0.000 0471 238 9	77	0.000 1343 903 5
28	0.000 0488 692 2	78	0.000 1361 356 8
29	0.000 0506 145 5	79	0.000 1378 810 1
0.00 30	0.000 0523 598 8	0.00 80	0.000 1396 263 4
31	0.000 0541 052 1	81	0.000 1413 716 7
32	0.000 0558 505 4	82	0.000 1431 170 0
33	0.000 0575 958 7	83	0.000 1448 623 3
34	0.000 0593 411 9	84	0.000 1466 076 6
35	0.000 0610 865 2	85	0.000 1483 529 9
36	0.000 0628 318 5	86	0.000 1500 983 2
37	0.000 0645 771 8	87	0.000 1518 436 4
38	0.000 0663 225 1	88	0.000 1535 889 7
39	0.000 0680 678 4	89	0.000 1553 343 0
0.00 40	0.000 0698 131 7	0.00 90	0.000 1570 796 3
41	0.000 0715 585 0	91	0.000 1588 249 6
42	0.000 0733 038 3	92	0.000 1605 702 9
43	0.000 0750 491 6	93	0.000 1623 156 2
44	0.000 0767 944 9	94	0.000 1640 609 5
45	0.000 0785 398 2	95	0.000 1658 062 8
46	0.000 0802 851 5	96	0.000 1675 516 1
47	0.000 0820 304 7	97	0.000 1692 969 4
48	0.000 0837 758 0	98	0.000 1710 422 7
49	0.000 0855 211 3	99	0.000 1727 876 0
	Bogen		Bogen

maß in Bogenmaß (Schluß)

°	Bogen	°	Bogen
0.00 00 00	0.000 0000 000 0	0.00 00 50	0.000 0008 726 6
01	0.000 0000 174 5	51	0.000 0008 901 2
02	0.000 0000 349 1	52	0.000 0009 075 7
03	0.000 0000 523 6	53	0.000 0009 250 2
04	0.000 0000 698 1	54	0.000 0009 424 8
05	0.000 0000 872 7	55	0.000 0009 599 3
06	0.000 0001 047 2	56	0.000 0009 773 8
07	0.000 0001 221 7	57	0.000 0009 948 4
08	0.000 0001 396 3	58	0.000 0010 122 9
09	0.000 0001 570 8	59	0.000 0010 297 4
0.00 00 10	0.000 0001 745 3	0.00 00 60	0.000 0010 472 0
11	0.000 0001 919 9	61	0.000 0010 646 5
12	0.000 0002 094 4	62	0.000 0010 821 0
13	0.000 0002 268 9	63	0.000 0010 995 6
14	0.000 0002 443 5	64	0.000 0011 170 1
15	0.000 0002 618 0	65	0.000 0011 344 6
16	0.000 0002 792 5	66	0.000 0011 519 2
17	0.000 0002 967 1	67	0.000 0011 693 7
18	0.000 0003 141 6	68	0.000 0011 868 2
19	0.000 0003 316 1	69	0.000 0012 042 8
0.00 00 20	0.000 0003 490 7	0.00 00 70	0.000 0012 217 3
21	0.000 0003 665 2	71	0.000 0012 391 8
22	0.000 0003 839 7	72	0.000 0012 566 4
23	0.000 0004 014 3	73	0.000 0012 740 9
24	0.000 0004 188 8	74	0.000 0012 915 4
25	0.000 0004 363 3	75	0.000 0013 090 0
26	0.000 0004 537 9	76	0.000 0013 264 5
27	0.000 0004 712 4	77	0.000 0013 439 0
28	0.000 0004 886 9	78	0.000 0013 613 6
29	0.000 0005 061 5	79	0.000 0013 788 1
0.00 00 30	0.000 0005 236 0	0.00 00 80	0.000 0013 962 6
31	0.000 0005 410 5	81	0.000 0014 137 2
32	0.000 0005 585 1	82	0.000 0014 311 7
33	0.000 0005 759 6	83	0.000 0014 486 2
34	0.000 0005 934 1	84	0.000 0014 660 8
35	0.000 0006 108 7	85	0.000 0014 835 3
36	0.000 0006 283 2	86	0.000 0015 009 8
37	0.000 0006 457 7	87	0.000 0015 184 4
38	0.000 0006 632 3	88	0.000 0015 358 9
39	0.000 0006 806 8	89	0.000 0015 533 4
0.00 00 40	0.000 0006 981 3	0.00 00 90	0.000 0015 708 0
41	0.000 0007 155 8	91	0.000 0015 882 5
42	0.000 0007 330 4	92	0.000 0016 057 0
43	0.000 0007 504 9	93	0.000 0016 231 6
44	0.000 0007 679 4	94	0.000 0016 406 1
45	0.000 0007 854 0	95	0.000 0016 580 6
46	0.000 0008 028 5	96	0.000 0016 755 2
47	0.000 0008 203 0	97	0.000 0016 929 7
48	0.000 0008 377 6	98	0.000 0017 104 2
49	0.000 0008 552 1	99	0.000 0017 278 8
°	Bogen	°	Bogen

°	Bogen	°	Bogen
0.00 00 00 00	0.000 0000 000 0	0.00 00 00 50	0.000 0000 087 3
01	0.000 0000 001 7	51	0.000 0000 089 0
02	0.000 0000 003 5	52	0.000 0000 090 8
03	0.000 0000 005 2	53	0.000 0000 092 5
04	0.000 0000 007 0	54	0.000 0000 094 2
05	0.000 0000 008 7	55	0.000 0000 096 0
06	0.000 0000 010 5	56	0.000 0000 097 7
07	0.000 0000 012 2	57	0.000 0000 099 5
08	0.000 0000 014 0	58	0.000 0000 101 2
09	0.000 0000 015 7	59	0.000 0000 103 0
0.00 00 00 10	0.000 0000 017 5	0.00 00 00 60	0.000 0000 104 7
11	0.000 0000 019 2	61	0.000 0000 106 5
12	0.000 0000 020 9	62	0.000 0000 108 2
13	0.000 0000 022 7	63	0.000 0000 110 0
14	0.000 0000 024 4	64	0.000 0000 111 7
15	0.000 0000 026 2	65	0.000 0000 113 4
16	0.000 0000 027 9	66	0.000 0000 115 2
17	0.000 0000 029 7	67	0.000 0000 116 9
18	0.000 0000 031 4	68	0.000 0000 118 7
19	0.000 0000 033 2	69	0.000 0000 120 4
0.00 00 00 20	0.000 0000 034 9	0.00 00 00 70	0.000 0000 122 2
21	0.000 0000 036 7	71	0.000 0000 123 9
22	0.000 0000 038 4	72	0.000 0000 125 7
23	0.000 0000 040 1	73	0.000 0000 127 4
24	0.000 0000 041 9	74	0.000 0000 129 2
25	0.000 0000 043 6	75	0.000 0000 130 9
26	0.000 0000 045 4	76	0.000 0000 132 6
27	0.000 0000 047 1	77	0.000 0000 134 4
28	0.000 0000 048 9	78	0.000 0000 136 1
29	0.000 0000 050 6	79	0.000 0000 137 9
0.00 00 00 30	0.000 0000 052 4	0.00 00 00 80	0.000 0000 139 6
31	0.000 0000 054 1	81	0.000 0000 141 4
32	0.000 0000 055 9	82	0.000 0000 143 1
33	0.000 0000 057 6	83	0.000 0000 144 9
34	0.000 0000 059 3	84	0.000 0000 146 6
35	0.000 0000 061 1	85	0.000 0000 148 4
36	0.000 0000 062 8	86	0.000 0000 150 1
37	0.000 0000 064 6	87	0.000 0000 151 8
38	0.000 0000 066 3	88	0.000 0000 153 6
39	0.000 0000 068 1	89	0.000 0000 155 3
0.00 00 00 40	0.000 0000 069 8	0.00 00 00 90	0.000 0000 157 1
41	0.000 0000 071 6	91	0.000 0000 158 8
42	0.000 0000 073 3	92	0.000 0000 160 6
43	0.000 0000 075 0	93	0.000 0000 162 3
44	0.000 0000 076 8	94	0.000 0000 164 1
45	0.000 0000 078 5	95	0.000 0000 165 8
46	0.000 0000 080 3	96	0.000 0000 167 6
47	0.000 0000 082 0	97	0.000 0000 169 3
48	0.000 0000 083 8	98	0.000 0000 171 0
49	0.000 0000 085 5	99	0.000 0000 172 8
°	Bogen	°	Bogen

′	°	″	□
0	0.000 000 000	0	0.000 000 000
1	0.016 666 667	1	0.000 277 778
2	0.033 333 333	2	0.000 555 556
3	0.050 000 000	3	0.000 833 333
4	0.066 666 667	4	0.001 111 111
5	0.083 333 333	5	0.001 388 889
6	0.100 000 000	6	0.001 666 667
7	0.116 666 667	7	0.001 944 444
8	0.133 333 333	8	0.002 222 222
9	0.150 000 000	9	0.002 500 000
10	0.166 666 667	10	0.002 777 778
11	0.183 333 333	11	0.003 055 556
12	0.200 000 000	12	0.003 333 333
13	0.216 666 667	13	0.003 611 111
14	0.233 333 333	14	0.003 888 889
15	0.250 000 000	15	0.004 166 667
16	0.266 666 667	16	0.004 444 444
17	0.283 333 333	17	0.004 722 222
18	0.300 000 000	18	0.005 000 000
19	0.316 666 667	19	0.005 277 778
20	0.333 333 333	20	0.005 555 556
21	0.350 000 000	21	0.005 833 333
22	0.366 666 667	22	0.006 111 111
23	0.383 333 333	23	0.006 388 889
24	0.400 000 000	24	0.006 666 667
25	0.416 666 667	25	0.006 944 444
26	0.433 333 333	26	0.007 222 222
27	0.450 000 000	27	0.007 500 000
28	0.466 666 667	28	0.007 777 778
29	0.483 333 333	29	0.008 055 556
30	0.500 000 000	30	0.008 333 333
31	0.516 666 667	31	0.008 611 111
32	0.533 333 333	32	0.008 888 889
33	0.550 000 000	33	0.009 166 667
34	0.566 666 667	34	0.009 444 444
35	0.583 333 333	35	0.009 722 222
36	0.600 000 000	36	0.010 000 000
37	0.616 666 667	37	0.010 277 778
38	0.633 333 333	38	0.010 555 556
39	0.650 000 000	39	0.010 833 333
40	0.666 666 667	40	0.011 111 111
41	0.683 333 333	41	0.011 388 889
42	0.700 000 000	42	0.011 666 667
43	0.716 666 667	43	0.011 944 444
44	0.733 333 333	44	0.012 222 222
45	0.750 000 000	45	0.012 500 000
46	0.766 666 667	46	0.012 777 778
47	0.783 333 333	47	0.013 055 556
48	0.800 000 000	48	0.013 333 333
49	0.816 666 667	49	0.013 611 111
50	0.833 333 333	50	0.013 888 889
51	0.850 000 000	51	0.014 166 667
52	0.866 666 667	52	0.014 444 444
53	0.883 333 333	53	0.014 722 222
54	0.900 000 000	54	0.015 000 000
55	0.916 666 667	55	0.015 277 778
56	0.933 333 333	56	0.015 555 556
57	0.950 000 000	57	0.015 833 333
58	0.966 666 667	58	0.016 111 111
59	0.983 333 333	59	0.016 388 889

″	□	″	°
0.00	0.000 000 000	0.50	0.000 138 889
01	0.000 002 778	51	0.000 141 667
02	0.000 005 556	52	0.000 144 444
03	0.000 008 333	53	0.000 147 222
04	0.000 011 111	54	0.000 150 000
05	0.000 013 889	55	0.000 152 778
06	0.000 016 667	56	0.000 155 556
07	0.000 019 444	57	0.000 158 333
08	0.000 022 222	58	0.000 161 111
09	0.000 025 000	59	0.000 163 889
0.10	0.000 027 778	0.60	0.000 166 667
11	0.000 030 556	61	0.000 169 444
12	0.000 033 333	62	0.000 172 222
13	0.000 036 111	63	0.000 175 000
14	0.000 038 889	64	0.000 177 778
15	0.000 041 667	65	0.000 180 556
16	0.000 044 444	66	0.000 183 333
17	0.000 047 222	67	0.000 186 111
18	0.000 050 000	68	0.000 188 889
19	0.000 052 778	69	0.000 191 667
0.20	0.000 055 556	0.70	0.000 194 444
21	0.000 058 333	71	0.000 197 222
22	0.000 061 111	72	0.000 200 000
23	0.000 063 889	73	0.000 202 778
24	0.000 066 667	74	0.000 205 556
25	0.000 069 444	75	0.000 208 333
26	0.000 072 222	76	0.000 211 111
27	0.000 075 000	77	0.000 213 889
28	0.000 077 778	78	0.000 216 667
29	0.000 080 556	79	0.000 219 444
0.30	0.000 083 333	0.80	0.000 222 222
31	0.000 086 111	81	0.000 225 000
32	0.000 088 889	82	0.000 227 778
33	0.000 091 667	83	0.000 230 556
34	0.000 094 444	84	0.000 233 333
35	0.000 097 222	85	0.000 236 111
36	0.000 100 000	86	0.000 238 889
37	0.000 102 778	87	0.000 241 667
38	0.000 105 556	88	0.000 244 444
39	0.000 108 333	89	0.000 247 222
0.40	0.000 111 111	0.90	0.000 250 000
41	0.000 113 889	91	0.000 252 778
42	0.000 116 667	92	0.000 255 556
43	0.000 119 444	93	0.000 258 333
44	0.000 122 222	94	0.000 261 111
45	0.000 125 000	95	0.000 263 889
46	0.000 127 778	96	0.000 266 667
47	0.000 130 556	97	0.000 269 444
48	0.000 133 333	98	0.000 272 222
49	0.000 136 111	99	0.000 275 000

-Sekunden in Bruchteile des Grades

"	°	"	°
0.00 00	0.000 000 000	0.00 50	0.000 001 389
01	0.000 000 028	51	0.000 001 417
02	0.000 000 056	52	0.000 001 444
03	0.000 000 083	53	0.000 001 472
04	0.000 000 111	54	0.000 001 500
05	0.000 000 139	55	0.000 001 528
06	0.000 000 167	56	0.000 001 556
07	0.000 000 194	57	0.000 001 583
08	0.000 000 222	58	0.000 001 611
09	0.000 000 250	59	0.000 001 639
0.00 10	0.000 000 278	0.00 60	0.000 001 667
11	0.000 000 306	61	0.000 001 694
12	0.000 000 333	62	0.000 001 722
13	0.000 000 361	63	0.000 001 750
14	0.000 000 389	64	0.000 001 778
15	0.000 000 417	65	0.000 001 806
16	0.000 000 444	66	0.000 001 833
17	0.000 000 472	67	0.000 001 861
18	0.000 000 500	68	0.000 001 889
19	0.000 000 528	69	0.000 001 917
0.00 20	0.000 000 556	0.00 70	0.000 001 944
21	0.000 000 583	71	0.000 001 972
22	0.000 000 611	72	0.000 002 000
23	0.000 000 639	73	0.000 002 028
24	0.000 000 667	74	0.000 002 056
25	0.000 000 694	75	0.000 002 083
26	0.000 000 722	76	0.000 002 111
27	0.000 000 750	77	0.000 002 139
28	0.000 000 778	78	0.000 002 167
29	0.000 000 806	79	0.000 002 194
0.00 30	0.000 000 833	0.00 80	0.000 002 222
31	0.000 000 861	81	0.000 002 250
32	0.000 000 889	82	0.000 002 278
33	0.000 000 917	83	0.000 002 306
34	0.000 000 944	84	0.000 002 333
35	0.000 000 972	85	0.000 002 361
36	0.000 001 000	86	0.000 002 389
37	0.000 001 028	87	0.000 002 417
38	0.000 001 056	88	0.000 002 444
39	0.000 001 083	89	0.000 002 472
0.00 40	0.000 001 111	0.00 90	0.000 002 500
41	0.000 001 139	91	0.000 002 528
42	0.000 001 167	92	0.000 002 556
43	0.000 001 194	93	0.000 002 583
44	0.000 001 222	94	0.000 002 611
45	0.000 001 250	95	0.000 002 639
46	0.000 001 278	96	0.000 002 667
47	0.000 001 306	97	0.000 002 694
48	0.000 001 333	98	0.000 002 722
49	0.000 001 361	99	0.000 002 750

"	°
0.00 00 0	0.000 000 000
1	0.000 000 003
2	0.000 000 006
3	0.000 000 008
4	0.000 000 011
5	0.000 000 014
6	0.000 000 017
7	0.000 000 019
8	0.000 000 022
9	0.000 000 025

	′	″		′	″
°	′	″	°	′	″
0.00	0	0	0.50	30	0
01	0	36	51	30	36
02	1	12	52	31	12
03	1	48	53	31	48
04	2	24	54	32	24
05	3	0	55	33	0
06	3	36	56	33	36
07	4	12	57	34	12
08	4	48	58	34	48
09	5	24	59	35	24
0.10	6	0	0.60	36	0
11	6	36	61	36	36
12	7	12	62	37	12
13	7	48	63	37	48
14	8	24	64	38	24
15	9	0	65	39	0
16	9	36	66	39	36
17	10	12	67	40	12
18	10	48	68	40	48
19	11	24	69	41	24
0.20	12	0	0.70	42	0
21	12	36	71	42	36
22	13	12	72	43	12
23	13	48	73	43	48
24	14	24	74	44	24
25	15	0	75	45	0
26	15	36	76	45	36
27	16	12	77	46	12
28	16	48	78	46	48
29	17	24	79	47	24
0.30	18	0	0.80	48	0
31	18	36	81	48	36
32	19	12	82	49	12
33	19	48	83	49	48
34	20	24	84	50	24
35	21	0	85	51	0
36	21	36	86	51	36
37	22	12	87	52	12
38	22	48	88	52	48
39	23	24	89	53	24
0.40	24	0	0.90	54	0
41	24	36	91	54	36
42	25	12	92	55	12
43	25	48	93	55	48
44	26	24	94	56	24
45	27	0	95	57	0
46	27	36	96	57	36
47	28	12	97	58	12
48	28	48	98	58	48
49	29	24	99	59	24
	′	″		′	″

	″		″
°	″	°	″
0.00 00	0.00	0.00 50	18.00
01	0.36	51	18.36
02	0.72	52	18.72
03	1.08	53	19.08
04	1.44	54	19.44
05	1.80	55	19.80
06	2.16	56	20.16
07	2.52	57	20.52
08	2.88	58	20.88
09	3.24	59	21.24
0.00 10	3.60	0.00 60	21.60
11	3.96	61	21.96
12	4.32	62	22.32
13	4.68	63	22.68
14	5.04	64	23.04
15	5.40	65	23.40
16	5.76	66	23.76
17	6.12	67	24.12
18	6.48	68	24.48
19	6.84	69	24.84
0.00 20	7.20	0.00 70	25.20
21	7.56	71	25.56
22	7.92	72	25.92
23	8.28	73	26.28
24	8.64	74	26.64
25	9.00	75	27.00
26	9.36	76	27.36
27	9.72	77	27.72
28	10.08	78	28.08
29	10.44	79	28.44
0.00 30	10.80	0.00 80	28.80
31	11.16	81	29.16
32	11.52	82	29.52
33	11.88	83	29.88
34	12.24	84	30.24
35	12.60	85	30.60
36	12.96	86	30.96
37	13.32	87	31.32
38	13.68	88	31.68
39	14.04	89	32.04
0.00 40	14.40	0.00 90	32.40
41	14.76	91	32.76
42	15.12	92	33.12
43	15.48	93	33.48
44	15.84	94	33.84
45	16.20	95	34.20
46	16.56	96	34.56
47	16.92	97	34.92
48	17.28	98	35.28
49	17.64	99	35.64
	″		″

in Bogen-Minuten und -Sekunden

°	′	°	′
0.00 00 00	0.00 00	0.00 00 50	0.18 00
01	0.00 36	51	0.18 36
02	0.00 72	52	0.18 72
03	0.01 08	53	0.19 08
04	0.01 44	54	0.19 44
05	0.01 80	55	0.19 80
06	0.02 16	56	0.20 16
07	0.02 52	57	0.20 52
08	0.02 88	58	0.20 88
09	0.03 24	59	0.21 24
0.00 00 10	0.03 60	0.00 00 60	0.21 60
11	0.03 96	61	0.21 96
12	0.04 32	62	0.22 32
13	0.04 68	63	0.22 68
14	0.05 04	64	0.23 04
15	0.05 40	65	0.23 40
16	0.05 76	66	0.23 76
17	0.06 12	67	0.24 12
18	0.06 48	68	0.24 48
19	0.06 84	69	0.24 84
0.00 00 20	0.07 20	0.00 00 70	0.25 20
21	0.07 56	71	0.25 56
22	0.07 92	72	0.25 92
23	0.08 28	73	0.26 28
24	0.08 64	74	0.26 64
25	0.09 00	75	0.27 00
26	0.09 36	76	0.27 36
27	0.09 72	77	0.27 72
28	0.10 08	78	0.28 08
29	0.10 44	79	0.28 44
0.00 00 30	0.10 80	0.00 00 80	0.28 80
31	0.11 16	81	0.29 16
32	0.11 52	82	0.29 52
33	0.11 88	83	0.29 88
34	0.12 24	84	0.30 24
35	0.12 60	85	0.30 60
36	0.12 96	86	0.30 96
37	0.13 32	87	0.31 32
38	0.13 68	88	0.31 68
39	0.14 04	89	0.32 04
0.00 00 40	0.14 40	0.00 00 90	0.32 40
41	0.14 76	91	0.32 76
42	0.15 12	92	0.33 12
43	0.15 48	93	0.33 48
44	0.15 84	94	0.33 84
45	0.16 20	95	0.34 20
46	0.16 56	96	0.34 56
47	0.16 92	97	0.34 92
48	0.17 28	98	0.35 28
49	0.17 64	99	0.35 64
	″		″

	″		″
°	″	°	″
0.00 00 00 00	0.00 00 0	0.00 00 00 50	0.00 18 0
01	0.00 00 4	51	0.00 18 4
02	0.00 00 7	52	0.00 18 7
03	0.00 01 1	53	0.00 19 1
04	0.00 01 4	54	0.00 19 4
05	0.00 01 8	55	0.00 19 8
06	0.00 02 2	56	0.00 20 2
07	0.00 02 5	57	0.00 20 5
08	0.00 02 9	58	0.00 20 9
09	0.00 03 2	59	0.00 21 2
0.00 00 00 10	0.00 03 6	0.00 00 00 60	0.00 21 6
11	0.00 04 0	61	0.00 22 0
12	0.00 04 3	62	0.00 22 3
13	0.00 04 7	63	0.00 22 7
14	0.00 05 0	64	0.00 23 0
15	0.00 05 4	65	0.00 23 4
16	0.00 05 8	66	0.00 23 8
17	0.00 06 1	67	0.00 24 1
18	0.00 06 5	68	0.00 24 5
19	0.00 06 8	69	0.00 24 8
0.00 00 00 20	0.00 07 2	0.00 00 00 70	0.00 25 2
21	0.00 07 6	71	0.00 25 6
22	0.00 07 9	72	0.00 25 9
23	0.00 08 3	73	0.00 26 3
24	0.00 08 6	74	0.00 26 6
25	0.00 09 0	75	0.00 27 0
26	0.00 09 4	76	0.00 27 4
27	0.00 09 7	77	0.00 27 7
28	0.00 10 1	78	0.00 28 1
29	0.00 10 4	79	0.00 28 4
0.00 00 00 30	0.00 10 8	0.00 00 00 80	0.00 28 8
31	0.00 11 2	81	0.00 29 2
32	0.00 11 5	82	0.00 29 5
33	0.00 11 9	83	0.00 29 9
34	0.00 12 2	84	0.00 30 2
35	0.00 12 6	85	0.00 30 6
36	0.00 13 0	86	0.00 31 0
37	0.00 13 3	87	0.00 31 3
38	0.00 13 7	88	0.00 31 7
39	0.00 14 0	89	0.00 32 0
0.00 00 00 40	0.00 14 4	0.00 00 00 90	0.00 32 4
41	0.00 14 8	91	0.00 32 8
42	0.00 15 1	92	0.00 33 1
43	0.00 15 5	93	0.00 33 5
44	0.00 15 8	94	0.00 33 8
45	0.00 16 2	95	0.00 34 2
46	0.00 16 6	96	0.00 34 6
47	0.00 16 9	97	0.00 34 9
48	0.00 17 3	98	0.00 35 3
49	0.00 17 6	99	0.00 35 6
	″		″

h	°
0	0
1	15
2	30
3	45
4	60
5	75
6	90
7	105
8	120
9	135
10	150
11	165
12	180
13	195
14	210
15	225
16	240
17	255
18	270
19	285
20	300
21	315
22	330
23	345

m	°
0	0.00
1	0.25
2	0.50
3	0.75
4	1.00
5	1.25
6	1.50
7	1.75
8	2.00
9	2.25
10	2.50
11	2.75
12	3.00
13	3.25
14	3.50
15	3.75
16	4.00
17	4.25
18	4.50
19	4.75
20	5.00
21	5.25
22	5.50
23	5.75
24	6.00
25	6.25
26	6.50
27	6.75
28	7.00
29	7.25
30	7.50
31	7.75
32	8.00
33	8.25
34	8.50
35	8.75
36	9.00
37	9.25
38	9.50
39	9.75
40	10.00
41	10.25
42	10.50
43	10.75
44	11.00
45	11.25
46	11.50
47	11.75
48	12.00
49	12.25
50	12.50
51	12.75
52	13.00
53	13.25
54	13.50
55	13.75
56	14.00
57	14.25
58	14.50
59	14.75

s	°
0	0.000 000 000
1	0.004 166 667
2	0.008 333 333
3	0.012 500 000
4	0.016 666 667
5	0.020 833 333
6	0.025 000 000
7	0.029 166 667
8	0.033 333 333
9	0.037 500 000
10	0.041 666 667
11	0.045 833 333
12	0.050 000 000
13	0.054 166 667
14	0.058 333 333
15	0.062 500 000
16	0.066 666 667
17	0.070 833 333
18	0.075 000 000
19	0.079 166 667
20	0.083 333 333
21	0.087 500 000
22	0.091 666 667
23	0.095 833 333
24	0.100 000 000
25	0.104 166 667
26	0.108 333 333
27	0.112 500 000
28	0.116 666 667
29	0.120 833 333
30	0.125 000 000
31	0.129 166 667
32	0.133 333 333
33	0.137 500 000
34	0.141 666 667
35	0.145 833 333
36	0.150 000 000
37	0.154 166 667
38	0.158 333 333
39	0.162 500 000
40	0.166 666 667
41	0.170 833 333
42	0.175 000 000
43	0.179 166 667
44	0.183 333 333
45	0.187 500 000
46	0.191 666 667
47	0.195 833 333
48	0.200 000 000
49	0.204 166 667
50	0.208 333 333
51	0.212 500 000
52	0.216 666 667
53	0.220 833 333
54	0.225 000 000
55	0.229 166 667
56	0.233 333 333
57	0.237 500 000
58	0.241 666 667
59	0.245 833 333

	Grad		Grad
s	°	s	°
0.00	0.000 000 000	0.50	0.002 083 333
01	0.000 041 667	51	0.002 125 000
02	0.000 083 333	52	0.002 166 667
03	0.000 125 000	53	0.002 208 333
04	0.000 166 667	54	0.002 250 000
05	0.000 208 333	55	0.002 291 667
06	0.000 250 000	56	0.002 333 333
07	0.000 291 667	57	0.002 375 000
08	0.000 333 333	58	0.002 416 667
09	0.000 375 000	59	0.002 458 333
0.10	0.000 416 667	0.60	0.002 500 000
11	0.000 458 333	61	0.002 541 667
12	0.000 500 000	62	0.002 583 333
13	0.000 541 667	63	0.002 625 000
14	0.000 583 333	64	0.002 666 667
15	0.000 625 000	65	0.002 708 333
16	0.000 666 667	66	0.002 750 000
17	0.000 708 333	67	0.002 791 667
18	0.000 750 000	68	0.002 833 333
19	0.000 791 667	69	0.002 875 000
0.20	0.000 833 333	0.70	0.002 916 667
21	0.000 875 000	71	0.002 958 333
22	0.000 916 667	72	0.003 000 000
23	0.000 958 333	73	0.003 041 667
24	0.001 000 000	74	0.003 083 333
25	0.001 041 667	75	0.003 125 000
26	0.001 083 333	76	0.003 166 667
27	0.001 125 000	77	0.003 208 333
28	0.001 166 667	78	0.003 250 000
29	0.001 208 333	79	0.003 291 667
0.30	0.001 250 000	0.80	0.003 333 333
31	0.001 291 667	81	0.003 375 000
32	0.001 333 333	82	0.003 416 667
33	0.001 375 000	83	0.003 458 333
34	0.001 416 667	84	0.003 500 000
35	0.001 458 333	85	0.003 541 667
36	0.001 500 000	86	0.003 583 333
37	0.001 541 667	87	0.003 625 000
38	0.001 583 333	88	0.003 666 667
39	0.001 625 000	89	0.003 708 333
0.40	0.001 666 667	0.90	0.003 750 000
41	0.001 708 333	91	0.003 791 667
42	0.001 750 000	92	0.003 833 333
43	0.001 791 667	93	0.003 875 000
44	0.001 833 333	94	0.003 916 667
45	0.001 875 000	95	0.003 958 333
46	0.001 916 667	96	0.004 000 000
47	0.001 958 333	97	0.004 041 667
48	0.002 000 000	98	0.004 083 333
49	0.002 041 667	99	0.004 125 000
	Grad		Grad

Zeitmaß in Gradmaß

	Grad		Grad
s	°	s	°
0.00 00	0.000 000 000	0.00 50	0.000 020 833
01	0.000 000 417	51	0.000 021 250
02	0.000 000 833	52	0.000 021 667
03	0.000 001 250	53	0.000 022 083
04	0.000 001 667	54	0.000 022 500
05	0.000 002 083	55	0.000 022 917
06	0.000 002 500	56	0.000 023 333
07	0.000 002 917	57	0.000 023 750
08	0.000 003 333	58	0.000 024 167
09	0.000 003 750	59	0.000 024 583
0.00 10	0.000 004 167	0.00 60	0.000 025 000
11	0.000 004 583	61	0.000 025 417
12	0.000 005 000	62	0.000 025 833
13	0.000 005 417	63	0.000 026 250
14	0.000 005 833	64	0.000 026 667
15	0.000 006 250	65	0.000 027 083
16	0.000 006 667	66	0.000 027 500
17	0.000 007 083	67	0.000 027 917
18	0.000 007 500	68	0.000 028 333
19	0.000 007 917	69	0.000 028 750
0.00 20	0.000 008 333	0.00 70	0.000 029 167
21	0.000 008 750	71	0.000 029 583
22	0.000 009 167	72	0.000 030 000
23	0.000 009 583	73	0.000 030 417
24	0.000 010 000	74	0.000 030 833
25	0.000 010 417	75	0.000 031 250
26	0.000 010 833	76	0.000 031 667
27	0.000 011 250	77	0.000 032 083
28	0.000 011 667	78	0.000 032 500
29	0.000 012 083	79	0.000 032 917
0.00 30	0.000 012 500	0.00 80	0.000 033 333
31	0.000 012 917	81	0.000 033 750
32	0.000 013 333	82	0.000 034 167
33	0.000 013 750	83	0.000 034 583
34	0.000 014 167	84	0.000 035 000
35	0.000 014 583	85	0.000 035 417
36	0.000 015 000	86	0.000 035 833
37	0.000 015 417	87	0.000 036 250
38	0.000 015 833	88	0.000 036 667
39	0.000 016 250	89	0.000 037 083
0.00 40	0.000 016 667	0.00 90	0.000 037 500
41	0.000 017 083	91	0.000 037 917
42	0.000 017 500	92	0.000 038 333
43	0.000 017 917	93	0.000 038 750
44	0.000 018 333	94	0.000 039 167
45	0.000 018 750	95	0.000 039 583
46	0.000 019 167	96	0.000 040 000
47	0.000 019 583	97	0.000 040 417
48	0.000 020 000	98	0.000 040 833
49	0.000 020 417	99	0.000 041 250
	Grad		Grad

	Grad		Grad
s	°	s	°
0.00 00 00	0.000 000 000	0.00 00 50	0.000 000 208
01	0.000 000 004	51	0.000 000 212
02	0.000 000 008	52	0.000 000 217
03	0.000 000 012	53	0.000 000 221
04	0.000 000 017	54	0.000 000 225
05	0.000 000 021	55	0.000 000 229
06	0.000 000 025	56	0.000 000 233
07	0.000 000 029	57	0.000 000 237
08	0.000 000 033	58	0.000 000 242
09	0.000 000 037	59	0.000 000 246
0.00 00 10	0.000 000 042	0.00 00 60	0.000 000 250
11	0.000 000 046	61	0.000 000 254
12	0.000 000 050	62	0.000 000 258
13	0.000 000 054	63	0.000 000 262
14	0.000 000 058	64	0.000 000 267
15	0.000 000 062	65	0.000 000 271
16	0.000 000 067	66	0.000 000 275
17	0.000 000 071	67	0.000 000 279
18	0.000 000 075	68	0.000 000 283
19	0.000 000 079	69	0.000 000 287
0.00 00 20	0.000 000 083	0.00 00 70	0.000 000 292
21	0.000 000 087	71	0.000 000 296
22	0.000 000 092	72	0.000 000 300
23	0.000 000 096	73	0.000 000 304
24	0.000 000 100	74	0.000 000 308
25	0.000 000 104	75	0.000 000 312
26	0.000 000 108	76	0.000 000 317
27	0.000 000 112	77	0.000 000 321
28	0.000 000 117	78	0.000 000 325
29	0.000 000 121	79	0.000 000 329
0.00 00 30	0.000 000 125	0.00 00 80	0.000 000 333
31	0.000 000 129	81	0.000 000 337
32	0.000 000 133	82	0.000 000 342
33	0.000 000 137	83	0.000 000 346
34	0.000 000 142	84	0.000 000 350
35	0.000 000 146	85	0.000 000 354
36	0.000 000 150	86	0.000 000 358
37	0.000 000 154	87	0.000 000 362
38	0.000 000 158	88	0.000 000 367
39	0.000 000 162	89	0.000 000 371
0.00 00 40	0.000 000 167	0.00 00 90	0.000 000 375
41	0.000 000 171	91	0.000 000 379
42	0.000 000 175	92	0.000 000 383
43	0.000 000 179	93	0.000 000 387
44	0.000 000 183	94	0.000 000 392
45	0.000 000 187	95	0.000 000 396
46	0.000 000 192	96	0.000 000 400
47	0.000 000 196	97	0.000 000 404
48	0.000 000 200	98	0.000 000 408
49	0.000 000 204	99	0.000 000 412
	Grad		Grad

°	h m	°	h m	°	h m	°	h m	°	h m	°	h m
0	0 0	60	4 0	120	8 0	180	12 0	240	16 0	300	20 0
1	4	61	4	121	4	181	4	241	4	301	4
2	8	62	8	122	8	182	8	242	8	302	8
3	12	63	12	123	12	183	12	243	12	303	12
4	16	64	16	124	16	184	16	244	16	304	16
5	20	65	20	125	20	185	20	245	20	305	20
6	24	66	24	126	24	186	24	246	24	306	24
7	28	67	28	127	28	187	28	247	28	307	28
8	32	68	32	128	32	188	32	248	32	308	32
9	36	69	36	129	36	189	36	249	36	309	36
10	0 40	70	4 40	130	8 40	190	12 40	250	16 40	310	20 40
11	44	71	44	131	44	191	44	251	44	311	44
12	48	72	48	132	48	192	48	252	48	312	48
13	52	73	52	133	52	193	52	253	52	313	52
14	0 56	74	4 56	134	8 56	194	12 56	254	16 56	314	20 56
15	1 0	75	5 0	135	9 0	195	13 0	255	17 0	315	21 0
16	4	76	4	136	4	196	4	256	4	316	4
17	8	77	8	137	8	197	8	257	8	317	8
18	12	78	12	138	12	198	12	258	12	318	12
19	16	79	16	139	16	199	16	259	16	319	16
20	1 20	80	5 20	140	9 20	200	13 20	260	17 20	320	21 20
21	24	81	24	141	24	201	24	261	24	321	24
22	28	82	28	142	28	202	28	262	28	322	28
23	32	83	32	143	32	203	32	263	32	323	32
24	36	84	36	144	36	204	36	264	36	324	36
25	40	85	40	145	40	205	40	265	40	325	40
26	44	86	44	146	44	206	44	266	44	326	44
27	48	87	48	147	48	207	48	267	48	327	48
28	52	88	52	148	52	208	52	268	52	328	52
29	1 56	89	5 56	149	9 56	209	13 56	269	17 56	329	21 56
30	2 0	90	6 0	150	10 0	210	14 0	270	18 0	330	22 0
31	4	91	4	151	4	211	4	271	4	331	4
32	8	92	8	152	8	212	8	272	8	332	8
33	12	93	12	153	12	213	12	273	12	333	12
34	16	94	16	154	16	214	16	274	16	334	16
35	20	95	20	155	20	215	20	275	20	335	20
36	24	96	24	156	24	216	24	276	24	336	24
37	28	97	28	157	28	217	28	277	28	337	28
38	32	98	32	158	32	218	32	278	32	338	32
39	36	99	36	159	36	219	36	279	36	339	36
40	2 40	100	6 40	160	10 40	220	14 40	280	18 40	340	22 40
41	44	101	44	161	44	221	44	281	44	341	44
42	48	102	48	162	48	222	48	282	48	342	48
43	52	103	52	163	52	223	52	283	52	343	52
44	2 56	104	6 56	164	10 56	224	14 56	284	18 56	344	22 56
45	3 0	105	7 0	165	11 0	225	15 0	285	19 0	345	23 0
46	4	106	4	166	4	226	4	286	4	346	4
47	8	107	8	167	8	227	8	287	8	347	8
48	12	108	12	168	12	228	12	288	12	348	12
49	16	109	16	169	16	229	16	289	16	349	16
50	3 20	110	7 20	170	11 20	230	15 20	290	19 20	350	23 20
51	24	111	24	171	24	231	24	291	24	351	24
52	28	112	28	172	28	232	28	292	28	352	28
53	32	113	32	173	32	233	32	293	32	353	32
54	36	114	36	174	36	234	36	294	36	354	36
55	40	115	40	175	40	235	40	295	40	355	40
56	44	116	44	176	44	236	44	296	44	356	44
57	48	117	48	177	48	237	48	297	48	357	48
58	52	118	52	178	52	238	52	298	52	358	52
59	56	119	56	179	56	239	56	299	56	359	56

Gradmaß in Zeitmaß

	m s		m s
°	m s	°	m s
0.00	0 0.0	0.50	2 0.0
01	0 2.4	51	2 2.4
02	0 4.8	52	2 4.8
03	0 7.2	53	2 7.2
04	0 9.6	54	2 9.6
05	0 12.0	55	2 12.0
06	0 14.4	56	2 14.4
07	0 16.8	57	2 16.8
08	0 19.2	58	2 19.2
09	0 21.6	59	2 21.6
0.10	0 24.0	0.60	2 24.0
11	0 26.4	61	2 26.4
12	0 28.8	62	2 28.8
13	0 31.2	63	2 31.2
14	0 33.6	64	2 33.6
15	0 36.0	65	2 36.0
16	0 38.4	66	2 38.4
17	0 40.8	67	2 40.8
18	0 43.2	68	2 43.2
19	0 45.6	69	2 45.6
0.20	0 48.0	0.70	2 48.0
21	0 50.4	71	2 50.4
22	0 52.8	72	2 52.8
23	0 55.2	73	2 55.2
24	0 57.6	74	2 57.6
25	1 0.0	75	3 0.0
26	1 2.4	76	3 2.4
27	1 4.8	77	3 4.8
28	1 7.2	78	3 7.2
29	1 9.6	79	3 9.6
0.30	1 12.0	0.80	3 12.0
31	1 14.4	81	3 14.4
32	1 16.8	82	3 16.8
33	1 19.2	83	3 19.2
34	1 21.6	84	3 21.6
35	1 24.0	85	3 24.0
36	1 26.4	86	3 26.4
37	1 28.8	87	3 28.8
38	1 31.2	88	3 31.2
39	1 33.6	89	3 33.6
0.40	1 36.0	0.90	3 36.0
41	1 38.4	91	3 38.4
42	1 40.8	92	3 40.8
43	1 43.2	93	3 43.2
44	1 45.6	94	3 45.6
45	1 48.0	95	3 48.0
46	1 50.4	96	3 50.4
47	1 52.8	97	3 52.8
48	1 55.2	98	3 55.2
49	1 57.6	99	3 57.6
	m s		m s

	s		s
°	s	°	s
0.00 00	0.000	0.00 50	1.200
01	0.024	51	1.224
02	0.048	52	1.248
03	0.072	53	1.272
04	0.096	54	1.296
05	0.120	55	1.320
06	0.144	56	1.344
07	0.168	57	1.368
08	0.192	58	1.392
09	0.216	59	1.416
0.00 10	0.240	0.00 60	1.440
11	0.264	61	1.464
12	0.288	62	1.488
13	0.312	63	1.512
14	0.336	64	1.536
15	0.360	65	1.560
16	0.384	66	1.584
17	0.408	67	1.608
18	0.432	68	1.632
19	0.456	69	1.656
0.00 20	0.480	0.00 70	1.680
21	0.504	71	1.704
22	0.528	72	1.728
23	0.552	73	1.752
24	0.576	74	1.776
25	0.600	75	1.800
26	0.624	76	1.824
27	0.648	77	1.848
28	0.672	78	1.872
29	0.696	79	1.896
0.00 30	0.720	0.00 80	1.920
31	0.744	81	1.944
32	0.768	82	1.968
33	0.792	83	1.992
34	0.816	84	2.016
35	0.840	85	2.040
36	0.864	86	2.064
37	0.888	87	2.088
38	0.912	88	2.112
39	0.936	89	2.136
0.00 40	0.960	0.00 90	2.160
41	0.984	91	2.184
42	1.008	92	2.208
43	1.032	93	2.232
44	1.056	94	2.256
45	1.080	95	2.280
46	1.104	96	2.304
47	1.128	97	2.328
48	1.152	98	2.352
49	1.176	99	2.376
	s		s

Verwandlung von Gradmaß in Zeitmaß (Schluß)

	Zeit		Zeit
°	s	°	s
0.00 00 00	0.00 00 0	0.00 00 50	0.01 20 0
01	0.00 02 4	51	0.01 22 4
02	0.00 04 8	52	0.01 24 8
03	0.00 07 2	53	0.01 27 2
04	0.00 09 6	54	0.01 29 6
05	0.00 12 0	55	0.01 32 0
06	0.00 14 4	56	0.01 34 4
07	0.00 16 8	57	0.01 36 8
08	0.00 19 2	58	0.01 39 2
09	0.00 21 6	59	0.01 41 6
0.00 00 10	0.00 24 0	0.00 00 60	0.01 44 0
11	0.00 26 4	61	0.01 46 4
12	0.00 28 8	62	0.01 48 8
13	0.00 31 2	63	0.01 51 2
14	0.00 33 6	64	0.01 53 6
15	0.00 36 0	65	0.01 56 0
16	0.00 38 4	66	0.01 58 4
17	0.00 40 8	67	0.01 60 8
18	0.00 43 2	68	0.01 63 2
19	0.00 45 6	69	0.01 65 6
0.00 00 20	0.00 48 0	0.00 00 70	0.01 68 0
21	0.00 50 4	71	0.01 70 4
22	0.00 52 8	72	0.01 72 8
23	0.00 55 2	73	0.01 75 2
24	0.00 57 6	74	0.01 77 6
25	0.00 60 0	75	0.01 80 0
26	0.00 62 4	76	0.01 82 4
27	0.00 64 8	77	0.01 84 8
28	0.00 67 2	78	0.01 87 2
29	0.00 69 6	79	0.01 89 6
0.00 00 30	0.00 72 0	0.00 00 80	0.01 92 0
31	0.00 74 4	81	0.01 94 4
32	0.00 76 8	82	0.01 96 8
33	0.00 79 2	83	0.01 99 2
34	0.00 81 6	84	0.02 01 6
35	0.00 84 0	85	0.02 04 0
36	0.00 86 4	86	0.02 06 4
37	0.00 88 8	87	0.02 08 8
38	0.00 91 2	88	0.02 11 2
39	0.00 93 6	89	0.02 13 6
0.00 00 40	0.00 96 0	0.00 00 90	0.02 16 0
41	0.00 98 4	91	0.02 18 4
42	0.01 00 8	92	0.02 20 8
43	0.01 03 2	93	0.02 23 2
44	0.01 05 6	94	0.02 25 6
45	0.01 08 0	95	0.02 28 0
46	0.01 10 4	96	0.02 30 4
47	0.01 12 8	97	0.02 32 8
48	0.01 15 2	98	0.02 35 2
49	0.01 17 6	99	0.02 37 6
	Zeit		Zeit

	Zeit		Zeit
°	s	°	s
0.00 00 00 00	0.00 00 00	0.00 00 00 50	0.00 01 20
01	0.00 00 02	51	0.00 01 22
02	0.00 00 05	52	0.00 01 25
03	0.00 00 07	53	0.00 01 27
04	0.00 00 10	54	0.00 01 30
05	0.00 00 12	55	0.00 01 32
06	0.00 00 14	56	0.00 01 34
07	0.00 00 17	57	0.00 01 37
08	0.00 00 19	58	0.00 01 39
09	0.00 00 22	59	0.00 01 42
0.00 00 00 10	0.00 00 24	0.00 00 00 60	0.00 01 44
11	0.00 00 26	61	0.00 01 46
12	0.00 00 29	62	0.00 01 49
13	0.00 00 31	63	0.00 01 51
14	0.00 00 34	64	0.00 01 54
15	0.00 00 36	65	0.00 01 56
16	0.00 00 38	66	0.00 01 58
17	0.00 00 41	67	0.00 01 61
18	0.00 00 43	68	0.00 01 63
19	0.00 00 46	69	0.00 01 66
0.00 00 00 20	0.00 00 48	0.00 00 00 70	0.00 01 68
21	0.00 00 50	71	0.00 01 70
22	0.00 00 53	72	0.00 01 73
23	0.00 00 55	73	0.00 01 75
24	0.00 00 58	74	0.00 01 78
25	0.00 00 60	75	0.00 01 80
26	0.00 00 62	76	0.00 01 82
27	0.00 00 65	77	0.00 01 85
28	0.00 00 67	78	0.00 01 87
29	0.00 00 70	79	0.00 01 90
0.00 00 00 30	0.00 00 72	0.00 00 00 80	0.00 01 92
31	0.00 00 74	81	0.00 01 94
32	0.00 00 77	82	0.00 01 97
33	0.00 00 79	83	0.00 01 99
34	0.00 00 82	84	0.00 02 02
35	0.00 00 84	85	0.00 02 04
36	0.00 00 86	86	0.00 02 06
37	0.00 00 89	87	0.00 02 09
38	0.00 00 91	88	0.00 02 11
39	0.00 00 94	89	0.00 02 14
0.00 00 00 40	0.00 00 96	0.00 00 00 90	0.00 02 16
41	0.00 00 98	91	0.00 02 18
42	0.00 01 01	92	0.00 02 21
43	0.00 01 03	93	0.00 02 23
44	0.00 01 06	94	0.00 02 26
45	0.00 01 08	95	0.00 02 28
46	0.00 01 10	96	0.00 02 30
47	0.00 01 13	97	0.00 02 33
48	0.00 01 15	98	0.00 02 35
49	0.00 01 18	99	0.00 02 38
	Zeit		Zeit

Verwandlung von neuem Gradmaß in altes Gradmaß

g	°	g	°	g	°	g	°	g	°	g	°	g	°	g	°
0	0.0	50	45.0	100	90.0	150	135.0	200	180.0	250	225.0	300	270.0	350	315.0
1	0.9	51	45.9	101	90.9	151	135.9	201	180.9	251	225.9	301	270.9	351	315.9
2	1.8	52	46.8	102	91.8	152	136.8	202	181.8	252	226.8	302	271.8	352	316.8
3	2.7	53	47.7	103	92.7	153	137.7	203	182.7	253	227.7	303	272.7	353	317.7
4	3.6	54	48.6	104	93.6	154	138.6	204	183.6	254	228.6	304	273.6	354	318.6
5	4.5	55	49.5	105	94.5	155	139.5	205	184.5	255	229.5	305	274.5	355	319.5
6	5.4	56	50.4	106	95.4	156	140.4	206	185.4	256	230.4	306	275.4	356	320.4
7	6.3	57	51.3	107	96.3	157	141.3	207	186.3	257	231.3	307	276.3	357	321.3
8	7.2	58	52.2	108	97.2	158	142.2	208	187.2	258	232.2	308	277.2	358	322.2
9	8.1	59	53.1	109	98.1	159	143.1	209	188.1	259	233.1	309	278.1	359	323.1
10	9.0	60	54.0	110	99.0	160	144.0	210	189.0	260	234.0	310	279.0	360	324.0
11	9.9	61	54.9	111	99.9	161	144.9	211	189.9	261	234.9	311	279.9	361	324.9
12	10.8	62	55.8	112	100.8	162	145.8	212	190.8	262	235.8	312	280.8	362	325.8
13	11.7	63	56.7	113	101.7	163	146.7	213	191.7	263	236.7	313	281.7	363	326.7
14	12.6	64	57.6	114	102.6	164	147.6	214	192.6	264	237.6	314	282.6	364	327.6
15	13.5	65	58.5	115	103.5	165	148.5	215	193.5	265	238.5	315	283.5	365	328.5
16	14.4	66	59.4	116	104.4	166	149.4	216	194.4	266	239.4	316	284.4	366	329.4
17	15.3	67	60.3	117	105.3	167	150.3	217	195.3	267	240.3	317	285.3	367	330.3
18	16.2	68	61.2	118	106.2	168	151.2	218	196.2	268	241.2	318	286.2	368	331.2
19	17.1	69	62.1	119	107.1	169	152.1	219	197.1	269	242.1	319	287.1	369	332.1
20	18.0	70	63.0	120	108.0	170	153.0	220	198.0	270	243.0	320	288.0	370	333.0
21	18.9	71	63.9	121	108.9	171	153.9	221	198.9	271	243.9	321	288.9	371	333.9
22	19.8	72	64.8	122	109.8	172	154.8	222	199.8	272	244.8	322	289.8	372	334.8
23	20.7	73	65.7	123	110.7	173	155.7	223	200.7	273	245.7	323	290.7	373	335.7
24	21.6	74	66.6	124	111.6	174	156.6	224	201.6	274	246.6	324	291.6	374	336.6
25	22.5	75	67.5	125	112.5	175	157.5	225	202.5	275	247.5	325	292.5	375	337.5
26	23.4	76	68.4	126	113.4	176	158.4	226	203.4	276	248.4	326	293.4	376	338.4
27	24.3	77	69.3	127	114.3	177	159.3	227	204.3	277	249.3	327	294.3	377	339.3
28	25.2	78	70.2	128	115.2	178	160.2	228	205.2	278	250.2	328	295.2	378	340.2
29	26.1	79	71.1	129	116.1	179	161.1	229	206.1	279	251.1	329	296.1	379	341.1
30	27.0	80	72.0	130	117.0	180	162.0	230	207.0	280	252.0	330	297.0	380	342.0
31	27.9	81	72.9	131	117.9	181	162.9	231	207.9	281	252.9	331	297.9	381	342.9
32	28.8	82	73.8	132	118.8	182	163.8	232	208.8	282	253.8	332	298.8	382	343.8
33	29.7	83	74.7	133	119.7	183	164.7	233	209.7	283	254.7	333	299.7	383	344.7
34	30.6	84	75.6	134	120.6	184	165.6	234	210.6	284	255.6	334	300.6	384	345.6
35	31.5	85	76.5	135	121.5	185	166.5	235	211.5	285	256.5	335	301.5	385	346.5
36	32.4	86	77.4	136	122.4	186	167.4	236	212.4	286	257.4	336	302.4	386	347.4
37	33.3	87	78.3	137	123.3	187	168.3	237	213.3	287	258.3	337	303.3	387	348.3
38	34.2	88	79.2	138	124.2	188	169.2	238	214.2	288	259.2	338	304.2	388	349.2
39	35.1	89	80.1	139	125.1	189	170.1	239	215.1	289	260.1	339	305.1	389	350.1
40	36.0	90	81.0	140	126.0	190	171.0	240	216.0	290	261.0	340	306.0	390	351.0
41	36.9	91	81.9	141	126.9	191	171.9	241	216.9	291	261.9	341	306.9	391	351.9
42	37.8	92	82.8	142	127.8	192	172.8	242	217.8	292	262.8	342	307.8	392	352.8
43	38.7	93	83.7	143	128.7	193	173.7	243	218.7	293	263.7	343	308.7	393	353.7
44	39.6	94	84.6	144	129.6	194	174.6	244	219.6	294	264.6	344	309.6	394	354.6
45	40.5	95	85.5	145	130.5	195	175.5	245	220.5	295	265.5	345	310.5	395	355.5
46	41.4	96	86.4	146	131.4	196	176.4	246	221.4	296	266.4	346	311.4	396	356.4
47	42.3	97	87.3	147	132.3	197	177.3	247	222.3	297	267.3	347	312.3	397	357.3
48	43.2	98	88.2	148	133.2	198	178.2	248	223.2	298	268.2	348	313.2	398	358.2
49	44.1	99	89.1	149	134.1	199	179.1	249	224.1	299	269.1	349	314.1	399	359.1

g	°	g	°
0.00	0.000	0.50	0.450
01	0.009	51	0.459
02	0.018	52	0.468
03	0.027	53	0.477
04	0.036	54	0.486
05	0.045	55	0.495
06	0.054	56	0.504
07	0.063	57	0.513
08	0.072	58	0.522
09	0.081	59	0.531
0.10	0.090	0.60	0.540
11	0.099	61	0.549
12	0.108	62	0.558
13	0.117	63	0.567
14	0.126	64	0.576
15	0.135	65	0.585
16	0.144	66	0.594
17	0.153	67	0.603
18	0.162	68	0.612
19	0.171	69	0.621
0.20	0.180	0.70	0.630
21	0.189	71	0.639
22	0.198	72	0.648
23	0.207	73	0.657
24	0.216	74	0.666
25	0.225	75	0.675
26	0.234	76	0.684
27	0.243	77	0.693
28	0.252	78	0.702
29	0.261	79	0.711
0.30	0.270	0.80	0.720
31	0.279	81	0.729
32	0.288	82	0.738
33	0.297	83	0.747
34	0.306	84	0.756
35	0.315	85	0.765
36	0.324	86	0.774
37	0.333	87	0.783
38	0.342	88	0.792
39	0.351	89	0.801
0.40	0.360	0.90	0.810
41	0.369	91	0.819
42	0.378	92	0.828
43	0.387	93	0.837
44	0.396	94	0.846
45	0.405	95	0.855
46	0.414	96	0.864
47	0.423	97	0.873
48	0.432	98	0.882
49	0.441	99	0.891

g	°	g	°
0.00 00	0.000 00	0.00 50	0.004 50
01	0.000 09	51	0.004 59
02	0.000 18	52	0.004 68
03	0.000 27	53	0.004 77
04	0.000 36	54	0.004 86
05	0.000 45	55	0.004 95
06	0.000 54	56	0.005 04
07	0.000 63	57	0.005 13
08	0.000 72	58	0.005 22
09	0.000 81	59	0.005 31
0.00 10	0.000 90	0.00 60	0.005 40
11	0.000 99	61	0.005 49
12	0.001 08	62	0.005 58
13	0.001 17	63	0.005 67
14	0.001 26	64	0.005 76
15	0.001 35	65	0.005 85
16	0.001 44	66	0.005 94
17	0.001 53	67	0.006 03
18	0.001 62	68	0.006 12
19	0.001 71	69	0.006 21
0.00 20	0.001 80	0.00 70	0.006 30
21	0.001 89	71	0.006 39
22	0.001 98	72	0.006 48
23	0.002 07	73	0.006 57
24	0.002 16	74	0.006 66
25	0.002 25	75	0.006 75
26	0.002 34	76	0.006 84
27	0.002 43	77	0.006 93
28	0.002 52	78	0.007 02
29	0.002 61	79	0.007 11
0.00 30	0.002 70	0.00 80	0.007 20
31	0.002 79	81	0.007 29
32	0.002 88	82	0.007 38
33	0.002 97	83	0.007 47
34	0.003 06	84	0.007 56
35	0.003 15	85	0.007 65
36	0.003 24	86	0.007 74
37	0.003 33	87	0.007 83
38	0.003 42	88	0.007 92
39	0.003 51	89	0.008 01
0.00 40	0.003 60	0.00 90	0.008 10
41	0.003 69	91	0.008 19
42	0.003 78	92	0.008 28
43	0.003 87	93	0.008 37
44	0.003 96	94	0.008 46
45	0.004 05	95	0.008 55
46	0.004 14	96	0.008 64
47	0.004 23	97	0.008 73
48	0.004 32	98	0.008 82
49	0.004 41	99	0.008 91

maß in altes Gradmaß (Schluß)

g	°	g	°
0.00 00 00	0.000 000 0	0.00 00 50	0.000 045 0
01	0.000 000 9	51	0.000 045 9
02	0.000 001 8	52	0.000 046 8
03	0.000 002 7	53	0.000 047 7
04	0.000 003 6	54	0.000 048 6
05	0.000 004 5	55	0.000 049 5
06	0.000 005 4	56	0.000 050 4
07	0.000 006 3	57	0.000 051 3
08	0.000 007 2	58	0.000 052 2
09	0.000 008 1	59	0.000 053 1
0.00 00 10	0.000 009 0	0.00 00 60	0.000 054 0
11	0.000 009 9	61	0.000 054 9
12	0.000 010 8	62	0.000 055 8
13	0.000 011 7	63	0.000 056 7
14	0.000 012 6	64	0.000 057 6
15	0.000 013 5	65	0.000 058 5
16	0.000 014 4	66	0.000 059 4
17	0.000 015 3	67	0.000 060 3
18	0.000 016 2	68	0.000 061 2
19	0.000 017 1	69	0.000 062 1
0.00 00 20	0.000 018 0	0.00 00 70	0.000 063 0
21	0.000 018 9	71	0.000 063 9
22	0.000 019 8	72	0.000 064 8
23	0.000 020 7	73	0.000 065 7
24	0.000 021 6	74	0.000 066 6
25	0.000 022 5	75	0.000 067 5
26	0.000 023 4	76	0.000 068 4
27	0.000 024 3	77	0.000 069 3
28	0.000 025 2	78	0.000 070 2
29	0.000 026 1	79	0.000 071 1
0.00 00 30	0.000 027 0	0.00 00 80	0.000 072 0
31	0.000 027 9	81	0.000 072 9
32	0.000 028 8	82	0.000 073 8
33	0.000 029 7	83	0.000 074 7
34	0.000 030 6	84	0.000 075 6
35	0.000 031 5	85	0.000 076 5
36	0.000 032 4	86	0.000 077 4
37	0.000 033 3	87	0.000 078 3
38	0.000 034 2	88	0.000 079 2
39	0.000 035 1	89	0.000 080 1
0.00 00 40	0.000 036 0	0.00 00 90	0.000 081 0
41	0.000 036 9	91	0.000 081 9
42	0.000 037 8	92	0.000 082 8
43	0.000 038 7	93	0.000 083 7
44	0.000 039 6	94	0.000 084 6
45	0.000 040 5	95	0.000 085 5
46	0.000 041 4	96	0.000 086 4
47	0.000 042 3	97	0.000 087 3
48	0.000 043 2	98	0.000 088 2
49	0.000 044 1	99	0.000 089 1

g	°	g	°
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02	0.000 000 018	52	0.000 000 468
03	0.000 000 027	53	0.000 000 477
04	0.000 000 036	54	0.000 000 486
05	0.000 000 045	55	0.000 000 495
06	0.000 000 054	56	0.000 000 504
07	0.000 000 063	57	0.000 000 513
08	0.000 000 072	58	0.000 000 522
09	0.000 000 081	59	0.000 000 531
0.00 00 00 10	0.000 000 090	0.00 00 00 60	0.000 000 540
11	0.000 000 099	61	0.000 000 549
12	0.000 000 108	62	0.000 000 558
13	0.000 000 117	63	0.000 000 567
14	0.000 000 126	64	0.000 000 576
15	0.000 000 135	65	0.000 000 585
16	0.000 000 144	66	0.000 000 594
17	0.000 000 153	67	0.000 000 603
18	0.000 000 162	68	0.000 000 612
19	0.000 000 171	69	0.000 000 621
0.00 00 00 20	0.000 000 180	0.00 00 00 70	0.000 000 630
21	0.000 000 189	71	0.000 000 639
22	0.000 000 198	72	0.000 000 648
23	0.000 000 207	73	0.000 000 657
24	0.000 000 216	74	0.000 000 666
25	0.000 000 225	75	0.000 000 675
26	0.000 000 234	76	0.000 000 684
27	0.000 000 243	77	0.000 000 693
28	0.000 000 252	78	0.000 000 702
29	0.000 000 261	79	0.000 000 711
0.00 00 00 30	0.000 000 270	0.00 00 00 80	0.000 000 720
31	0.000 000 279	81	0.000 000 729
32	0.000 000 288	82	0.000 000 738
33	0.000 000 297	83	0.000 000 747
34	0.000 000 306	84	0.000 000 756
35	0.000 000 315	85	0.000 000 765
36	0.000 000 324	86	0.000 000 774
37	0.000 000 333	87	0.000 000 783
38	0.000 000 342	88	0.000 000 792
39	0.000 000 351	89	0.000 000 801
0.00 00 00 40	0.000 000 360	0.00 00 00 90	0.000 000 810
41	0.000 000 369	91	0.000 000 819
42	0.000 000 378	92	0.000 000 828
43	0.000 000 387	93	0.000 000 837
44	0.000 000 396	94	0.000 000 846
45	0.000 000 405	95	0.000 000 855
46	0.000 000 414	96	0.000 000 864
47	0.000 000 423	97	0.000 000 873
48	0.000 000 432	98	0.000 000 882
49	0.000 000 441	99	0.000 000 891

°	g	°	g	°	g	°	g
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1	1.111 111 111	51	56.666 666 667	101	112.222 222 222	151	167.777 777 778
2	2.222 222 222	52	57.777 777 778	102	113.333 333 333	152	168.888 888 889
3	3.333 333 333	53	58.888 888 889	103	114.444 444 444	153	170.000 000 000
4	4.444 444 444	54	60.000 000 000	104	115.555 555 556	154	171.111 111 111
5	5.555 555 556	55	61.111 111 111	105	116.666 666 667	155	172.222 222 222
6	6.666 666 667	56	62.222 222 222	106	117.777 777 778	156	173.333 333 333
7	7.777 777 778	57	63.333 333 333	107	118.888 888 889	157	174.444 444 444
8	8.888 888 889	58	64.444 444 444	108	120.000 000 000	158	175.555 555 556
9	10.000 000 000	59	65.555 555 556	109	121.111 111 111	159	176.666 666 667
10	11.111 111 111	60	66.666 666 667	110	122.222 222 222	160	177.777 777 778
11	12.222 222 222	61	67.777 777 778	111	123.333 333 333	161	178.888 888 889
12	13.333 333 333	62	68.888 888 889	112	124.444 444 444	162	180.000 000 000
13	14.444 444 444	63	70.000 000 000	113	125.555 555 556	163	181.111 111 111
14	15.555 555 556	64	71.111 111 111	114	126.666 666 667	164	182.222 222 222
15	16.666 666 667	65	72.222 222 222	115	127.777 777 778	165	183.333 333 333
16	17.777 777 778	66	73.333 333 333	116	128.888 888 889	166	184.444 444 444
17	18.888 888 889	67	74.444 444 444	117	130.000 000 000	167	185.555 555 556
18	20.000 000 000	68	75.555 555 556	118	131.111 111 111	168	186.666 666 667
19	21.111 111 111	69	76.666 666 667	119	132.222 222 222	169	187.777 777 778
20	22.222 222 222	70	77.777 777 778	120	133.333 333 333	170	188.888 888 889
21	23.333 333 333	71	78.888 888 889	121	134.444 444 444	171	190.000 000 000
22	24.444 444 444	72	80.000 000 000	122	135.555 555 556	172	191.111 111 111
23	25.555 555 556	73	81.111 111 111	123	136.666 666 667	173	192.222 222 222
24	26.666 666 667	74	82.222 222 222	124	137.777 777 778	174	193.333 333 333
25	27.777 777 778	75	83.333 333 333	125	138.888 888 889	175	194.444 444 444
26	28.888 888 889	76	84.444 444 444	126	140.000 000 000	176	195.555 555 556
27	30.000 000 000	77	85.555 555 556	127	141.111 111 111	177	196.666 666 667
28	31.111 111 111	78	86.666 666 667	128	142.222 222 222	178	197.777 777 778
29	32.222 222 222	79	87.777 777 778	129	143.333 333 333	179	198.888 888 889
30	33.333 333 333	80	88.888 888 889	130	144.444 444 444	180	200.000 000 000
31	34.444 444 444	81	90.000 000 000	131	145.555 555 556	181	201.111 111 111
32	35.555 555 556	82	91.111 111 111	132	146.666 666 667	182	202.222 222 222
33	36.666 666 667	83	92.222 222 222	133	147.777 777 778	183	203.333 333 333
34	37.777 777 778	84	93.333 333 333	134	148.888 888 889	184	204.444 444 444
35	38.888 888 889	85	94.444 444 444	135	150.000 000 000	185	205.555 555 556
36	40.000 000 000	86	95.555 555 556	136	151.111 111 111	186	206.666 666 667
37	41.111 111 111	87	96.666 666 667	137	152.222 222 222	187	207.777 777 778
38	42.222 222 222	88	97.777 777 778	138	153.333 333 333	188	208.888 888 889
39	43.333 333 333	89	98.888 888 889	139	154.444 444 444	189	210.000 000 000
40	44.444 444 444	90	100.000 000 000	140	155.555 555 556	190	211.111 111 111
41	45.555 555 556	91	101.111 111 111	141	156.666 666 667	191	212.222 222 222
42	46.666 666 667	92	102.222 222 222	142	157.777 777 778	192	213.333 333 333
43	47.777 777 778	93	103.333 333 333	143	158.888 888 889	193	214.444 444 444
44	48.888 888 889	94	104.444 444 444	144	160.000 000 000	194	215.555 555 556
45	50.000 000 000	95	105.555 555 556	145	161.111 111 111	195	216.666 666 667
46	51.111 111 111	96	106.666 666 667	146	162.222 222 222	196	217.777 777 778
47	52.222 222 222	97	107.777 777 778	147	163.333 333 333	197	218.888 888 889
48	53.333 333 333	98	108.888 888 889	148	164.444 444 444	198	220.000 000 000
49	54.444 444 444	99	110.000 000 000	149	165.555 555 556	199	221.111 111 111

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200	222.222 222 222	250	277.777 777 778	300	333.333 333 333	350	388.888 888 889
201	223.333 333 333	251	278.888 888 889	301	334.444 444 444	351	390.000 000 000
202	224.444 444 444	252	280.000 000 000	302	335.555 555 556	352	391.111 111 111
203	225.555 555 556	253	281.111 111 111	303	336.666 666 667	353	392.222 222 222
204	226.666 666 667	254	282.222 222 222	304	337.777 777 778	354	393.333 333 333
205	227.777 777 778	255	283.333 333 333	305	338.888 888 889	355	394.444 444 444
206	228.888 888 889	256	284.444 444 444	306	340.000 000 000	356	395.555 555 556
207	230.000 000 000	257	285.555 555 556	307	341.111 111 111	357	396.666 666 667
208	231.111 111 111	258	286.666 666 667	308	342.222 222 222	358	397.777 777 778
209	232.222 222 222	259	287.777 777 778	309	343.333 333 333	359	398.888 888 889
210	233.333 333 333	260	288.888 888 889	310	344.444 444 444		
211	234.444 444 444	261	290.000 000 000	311	345.555 555 556		
212	235.555 555 556	262	291.111 111 111	312	346.666 666 667		
213	236.666 666 667	263	292.222 222 222	313	347.777 777 778		
214	237.777 777 778	264	293.333 333 333	314	348.888 888 889		
215	238.888 888 889	265	294.444 444 444	315	350.000 000 000		
216	240.000 000 000	266	295.555 555 556	316	351.111 111 111		
217	241.111 111 111	267	296.666 666 667	317	352.222 222 222		
218	242.222 222 222	268	297.777 777 778	318	353.333 333 333		
219	243.333 333 333	269	298.888 888 889	319	354.444 444 444		
220	244.444 444 444	270	300.000 000 000	320	355.555 555 556		
221	245.555 555 556	271	301.111 111 111	321	356.666 666 667		
222	246.666 666 667	272	302.222 222 222	322	357.777 777 778		
223	247.777 777 778	273	303.333 333 333	323	358.888 888 889		
224	248.888 888 889	274	304.444 444 444	324	360.000 000 000		
225	250.000 000 000	275	305.555 555 556	325	361.111 111 111		
226	251.111 111 111	276	306.666 666 667	326	362.222 222 222		
227	252.222 222 222	277	307.777 777 778	327	363.333 333 333		
228	253.333 333 333	278	308.888 888 889	328	364.444 444 444		
229	254.444 444 444	279	310.000 000 000	329	365.555 555 556		
230	255.555 555 556	280	311.111 111 111	330	366.666 666 667		
231	256.666 666 667	281	312.222 222 222	331	367.777 777 778		
232	257.777 777 778	282	313.333 333 333	332	368.888 888 889		
233	258.888 888 889	283	314.444 444 444	333	370.000 000 000		
234	260.000 000 000	284	315.555 555 556	334	371.111 111 111		
235	261.111 111 111	285	316.666 666 667	335	372.222 222 222		
236	262.222 222 222	286	317.777 777 778	336	373.333 333 333		
237	263.333 333 333	287	318.888 888 889	337	374.444 444 444		
238	264.444 444 444	288	320.000 000 000	338	375.555 555 556		
239	265.555 555 556	289	321.111 111 111	339	376.666 666 667		
240	266.666 666 667	290	322.222 222 222	340	377.777 777 778		
241	267.777 777 778	291	323.333 333 333	341	378.888 888 889		
242	268.888 888 889	292	324.444 444 444	342	380.000 000 000		
243	270.000 000 000	293	325.555 555 556	343	381.111 111 111		
244	271.111 111 111	294	326.666 666 667	344	382.222 222 222		
245	272.222 222 222	295	327.777 777 778	345	383.333 333 333		
246	273.333 333 333	296	328.888 888 889	346	384.444 444 444		
247	274.444 444 444	297	330.000 000 000	347	385.555 555 556		
248	275.555 555 556	298	331.111 111 111	348	386.666 666 667		
249	276.666 666 667	299	332.222 222 222	349	387.777 777 778		

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0.00	0.000 000 000	0.50	0.555 555 556
01	0.011 111 111	51	0.566 666 667
02	0.022 222 222	52	0.577 777 778
03	0.033 333 333	53	0.588 888 889
04	0.044 444 444	54	0.600 000 000
05	0.055 555 556	55	0.611 111 111
06	0.066 666 667	56	0.622 222 222
07	0.077 777 778	57	0.633 333 333
08	0.088 888 889	58	0.644 444 444
09	0.100 000 000	59	0.655 555 556
0.10	0.111 111 111	0.60	0.666 666 667
11	0.122 222 222	61	0.677 777 778
12	0.133 333 333	62	0.688 888 889
13	0.144 444 444	63	0.700 000 000
14	0.155 555 556	64	0.711 111 111
15	0.166 666 667	65	0.722 222 222
16	0.177 777 778	66	0.733 333 333
17	0.188 888 889	67	0.744 444 444
18	0.200 000 000	68	0.755 555 556
19	0.211 111 111	69	0.766 666 667
0.20	0.222 222 222	0.70	0.777 777 778
21	0.233 333 333	71	0.788 888 889
22	0.244 444 444	72	0.800 000 000
23	0.255 555 556	73	0.811 111 111
24	0.266 666 667	74	0.822 222 222
25	0.277 777 778	75	0.833 333 333
26	0.288 888 889	76	0.844 444 444
27	0.300 000 000	77	0.855 555 556
28	0.311 111 111	78	0.866 666 667
29	0.322 222 222	79	0.877 777 778
0.30	0.333 333 333	0.80	0.888 888 889
31	0.344 444 444	81	0.900 000 000
32	0.355 555 556	82	0.911 111 111
33	0.366 666 667	83	0.922 222 222
34	0.377 777 778	84	0.933 333 333
35	0.388 888 889	85	0.944 444 444
36	0.400 000 000	86	0.955 555 556
37	0.411 111 111	87	0.966 666 667
38	0.422 222 222	88	0.977 777 778
39	0.433 333 333	89	0.988 888 889
0.40	0.444 444 444	0.90	1.000 000 000
41	0.455 555 556	91	1.011 111 111
42	0.466 666 667	92	1.022 222 222
43	0.477 777 778	93	1.033 333 333
44	0.488 888 889	94	1.044 444 444
45	0.500 000 000	95	1.055 555 556
46	0.511 111 111	96	1.066 666 667
47	0.522 222 222	97	1.077 777 778
48	0.533 333 333	98	1.088 888 889
49	0.544 444 444	99	1.100 000 000

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01	0.000 111 111	51	0.005 666 667
02	0.000 222 222	52	0.005 777 778
03	0.000 333 333	53	0.005 888 889
04	0.000 444 444	54	0.006 000 000
05	0.000 555 556	55	0.006 111 111
06	0.000 666 667	56	0.006 222 222
07	0.000 777 778	57	0.006 333 333
08	0.000 888 889	58	0.006 444 444
09	0.001 000 000	59	0.006 555 556
0.00 10	0.001 111 111	0.00 60	0.006 666 667
11	0.001 222 222	61	0.006 777 778
12	0.001 333 333	62	0.006 888 889
13	0.001 444 444	63	0.007 000 000
14	0.001 555 556	64	0.007 111 111
15	0.001 666 667	65	0.007 222 222
16	0.001 777 778	66	0.007 333 333
17	0.001 888 889	67	0.007 444 444
18	0.002 000 000	68	0.007 555 556
19	0.002 111 111	69	0.007 666 667
0.00 20	0.002 222 222	0.00 70	0.007 777 778
21	0.002 333 333	71	0.007 888 889
22	0.002 444 444	72	0.008 000 000
23	0.002 555 556	73	0.008 111 111
24	0.002 666 667	74	0.008 222 222
25	0.002 777 778	75	0.008 333 333
26	0.002 888 889	76	0.008 444 444
27	0.003 000 000	77	0.008 555 556
28	0.003 111 111	78	0.008 666 667
29	0.003 222 222	79	0.008 777 778
0.00 30	0.003 333 333	0.00 80	0.008 888 889
31	0.003 444 444	81	0.009 000 000
32	0.003 555 556	82	0.009 111 111
33	0.003 666 667	83	0.009 222 222
34	0.003 777 778	84	0.009 333 333
35	0.003 888 889	85	0.009 444 444
36	0.004 000 000	86	0.009 555 556
37	0.004 111 111	87	0.009 666 667
38	0.004 222 222	88	0.009 777 778
39	0.004 333 333	89	0.009 888 889
0.00 40	0.004 444 444	0.00 90	0.010 000 000
41	0.004 555 556	91	0.010 111 111
42	0.004 666 667	92	0.010 222 222
43	0.004 777 778	93	0.010 333 333
44	0.004 888 889	94	0.010 444 444
45	0.005 000 000	95	0.010 555 556
46	0.005 111 111	96	0.010 666 667
47	0.005 222 222	97	0.010 777 778
48	0.005 333 333	98	0.010 888 889
49	0.005 444 444	99	0.011 000 000

°	g	°	g
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01	0.000 001 111	51	0.000 056 667
02	0.000 002 222	52	0.000 057 778
03	0.000 003 333	53	0.000 058 889
04	0.000 004 444	54	0.000 060 000
05	0.000 005 556	55	0.000 061 111
06	0.000 006 667	56	0.000 062 222
07	0.000 007 778	57	0.000 063 333
08	0.000 008 889	58	0.000 064 444
09	0.000 010 000	59	0.000 065 556
0.00 00 10	0.000 011 111	0.00 00 60	0.000 066 667
11	0.000 012 222	61	0.000 067 778
12	0.000 013 333	62	0.000 068 889
13	0.000 014 444	63	0.000 070 000
14	0.000 015 556	64	0.000 071 111
15	0.000 016 667	65	0.000 072 222
16	0.000 017 778	66	0.000 073 333
17	0.000 018 889	67	0.000 074 444
18	0.000 020 000	68	0.000 075 556
19	0.000 021 111	69	0.000 076 667
0.00 00 20	0.000 022 222	0.00 00 70	0.000 077 778
21	0.000 023 333	71	0.000 078 889
22	0.000 024 444	72	0.000 080 000
23	0.000 025 556	73	0.000 081 111
24	0.000 026 667	74	0.000 082 222
25	0.000 027 778	75	0.000 083 333
26	0.000 028 889	76	0.000 084 444
27	0.000 030 000	77	0.000 085 556
28	0.000 031 111	78	0.000 086 667
29	0.000 032 222	79	0.000 087 778
0.00 00 30	0.000 033 333	0.00 00 80	0.000 088 889
31	0.000 034 444	81	0.000 090 000
32	0.000 035 556	82	0.000 091 111
33	0.000 036 667	83	0.000 092 222
34	0.000 037 778	84	0.000 093 333
35	0.000 038 889	85	0.000 094 444
36	0.000 040 000	86	0.000 095 556
37	0.000 041 111	87	0.000 096 667
38	0.000 042 222	88	0.000 097 778
39	0.000 043 333	89	0.000 098 889
0.00 00 40	0.000 044 444	0.00 00 90	0.000 100 000
41	0.000 045 556	91	0.000 101 111
42	0.000 046 667	92	0.000 102 222
43	0.000 047 778	93	0.000 103 333
44	0.000 048 889	94	0.000 104 444
45	0.000 050 000	95	0.000 105 556
46	0.000 051 111	96	0.000 106 667
47	0.000 052 222	97	0.000 107 778
48	0.000 053 333	98	0.000 108 889
49	0.000 054 444	99	0.000 110 000

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0.00 00 00 00	0.000 000 000	0.00 00 00 50	0.000 000 556
01	0.000 000 011	51	0.000 000 567
02	0.000 000 022	52	0.000 000 578
03	0.000 000 033	53	0.000 000 589
04	0.000 000 044	54	0.000 000 600
05	0.000 000 056	55	0.000 000 611
06	0.000 000 067	56	0.000 000 622
07	0.000 000 078	57	0.000 000 633
08	0.000 000 089	58	0.000 000 644
09	0.000 000 100	59	0.000 000 656
0.00 00 00 10	0.000 000 111	0.00 00 00 60	0.000 000 667
11	0.000 000 122	61	0.000 000 678
12	0.000 000 133	62	0.000 000 689
13	0.000 000 144	63	0.000 000 700
14	0.000 000 156	64	0.000 000 711
15	0.000 000 167	65	0.000 000 722
16	0.000 000 178	66	0.000 000 733
17	0.000 000 189	67	0.000 000 744
18	0.000 000 200	68	0.000 000 756
19	0.000 000 211	69	0.000 000 767
0.00 00 00 20	0.000 000 222	0.00 00 00 70	0.000 000 778
21	0.000 000 233	71	0.000 000 789
22	0.000 000 244	72	0.000 000 800
23	0.000 000 256	73	0.000 000 811
24	0.000 000 267	74	0.000 000 822
25	0.000 000 278	75	0.000 000 833
26	0.000 000 289	76	0.000 000 844
27	0.000 000 300	77	0.000 000 856
28	0.000 000 311	78	0.000 000 867
29	0.000 000 322	79	0.000 000 878
0.00 00 00 30	0.000 000 333	0.00 00 00 80	0.000 000 889
31	0.000 000 344	81	0.000 000 900
32	0.000 000 356	82	0.000 000 911
33	0.000 000 367	83	0.000 000 922
34	0.000 000 378	84	0.000 000 933
35	0.000 000 389	85	0.000 000 944
36	0.000 000 400	86	0.000 000 956
37	0.000 000 411	87	0.000 000 967
38	0.000 000 422	88	0.000 000 978
39	0.000 000 433	89	0.000 000 989
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41	0.000 000 456	91	0.000 001 011
42	0.000 000 467	92	0.000 001 022
43	0.000 000 478	93	0.000 001 033
44	0.000 000 489	94	0.000 001 044
45	0.000 000 500	95	0.000 001 056
46	0.000 000 511	96	0.000 001 067
47	0.000 000 522	97	0.000 001 078
48	0.000 000 533	98	0.000 001 089
49	0.000 000 544	99	0.000 001 100

Zusätzliches Druckfehlerverzeichnis

redigiert von Charles J. Hyman

ehemaligem Berechner bei der Küsten- und Landvermessung der Vereinigten Staaten

Nach dem ersten Erscheinen der Tafeln von Peters-Stein erwiesen sich noch immer einige wenige von den Tafelwerten als fehlerhaft. Im folgenden sind mit den Fehlern auch die Namen derer angeführt, denen ihre Entdeckung zu verdanken ist:

Band I.

Nach L. S. Comrie (Mathematical Tables and Other Aids to Computation) (*Mathematische Tafeln und andere Rechenbehelfe*, Bd. 1, S. 57–59):

S. 16. log 11275. Statt 506 lies 505.
S. 406. log 69731. Statt 843 4358 934 lies 843 4258 934.
S. 566. log 93748. Statt 974 9620 114 lies 971 9620 114.

Anhang zu Band I

Seite

VII Nach C.R.Cosens, Engineering Laboratory (Technisches Laboratorium), Cambridge, England:

$$\text{Statt } \frac{B_3}{5 \cdot 6 \cdot n} \quad \text{lies } \frac{B_3}{5 \cdot 6 \cdot n^5}$$

Nach H. S. Uhler, Department of Physics (Lehrkanzel für Physik), Yale University, New Haven, Conn., Ver. St. v. A.

Natürliche Logarithmen (82-stellig)

XXIV ln 23. Die letzte Stelle soll richtig lauten: 2.
ln 41. Die letzten zwei Stellen sollen richtig lauten: 60.
ln 59. Die letzte Stelle soll richtig lauten: 4.
ln 61. Die letzte Stelle soll richtig lauten: 2.

XXV ln 71. Die letzten zwei Stellen sollen richtig lauten: 60.
ln 73. Die letzte Stelle soll richtig lauten: 3.
ln 97. Die letzte Stelle soll richtig lauten: 3.
ln 103. Die letzte Stelle soll richtig lauten: 6.
ln 107. Die letzte Stelle soll richtig lauten: 6.

Seite XXV

Gewöhnliche Logarithmen (84-stellig)

log 17. Die letzte Stelle soll richtig lauten: 6.
log 23. „ „ „ „ „ „ 4.
log 41. „ „ „ „ „ „ 3.
log 61. „ „ „ „ „ „ 7.
log 71. „ „ „ „ „ „ 0.
log 83. „ „ „ „ „ „ 0.
log 97. „ „ „ „ „ „ 6.
log 101. „ „ „ „ „ „ 0.
log 113. „ „ „ „ „ „ 8.

Seite XXVII

Berechnung von log 127

2 log 71. Die letzte Stelle soll lauten: 0.
s_1. Die letzten zwei Stellen sollen lauten: 28.
2 log 23. Die letzte Stelle soll lauten: 8.
2 log 41. Die letzte Stelle soll lauten: 6.
s_2. Die letzte Stelle soll lauten: 4.
log 127. Die letzten zwei Stellen sollen lauten: 14.

Berechnung von ln 127

2 ln 71. Die letzten zwei Stellen sollen lauten: 20.
s_1. Die letzte Stelle soll lauten: 6.
ln 127. Die letzte Stelle soll lauten: 6.

Seite 1. Berechnung von π durch die Rechenmaschine der Flottenartillerieforschungsstelle:
Angefangen von Zeile 9, Spalte 2 (nach der 527. Stelle) lies:

39494 63952 24737 19070 21798 60943 70277 05392 17176 29317 67523 84674
81846 76694 05132 00056 81271 45263 56082 77857 71342 75778 96091 73637 17872
14684 40901 22495 34301 46549 58537 10507 92279 68925 89235 42019 96

Nach H. S. Uhler, Lehrkanzel für Physik, Yale University

Seite 1. log π. Die letzte Stelle soll richtig lauten: 5, anstatt 6.

Mitgeteilt von J. Todd, National Bureau of Standards (Nationalnormenanstalt), Washington, D.C., Ver. St. v. A.

Seite 2. C. Zeile 4, Spalte 11, lies 571, anstatt 570.

Nach H. S. Uhler:

Seite 7. M. Angefangen von Zeile 4, Spalte 11, lies: 17253 83562 22813 95603 05.
1:M. Angefangen von Zeile 4, Spalte 11, lies: 43651 55048 93.
ln M. Zeile 10, lies: 63432 0083–10.

Mitgeteilt von J. Todd:

Seite 47. $1:42^n$. Zeile 5, Spalten 5, 6 sollen lauten: 85452 31863 76.
Seite 90. $n = 25$. Letzte Spalte, lies 71, anstatt 70.

Nach E. B. Escott:

Seite 131. Spalte 4 soll richtig lauten: 97458.

Nach C. R. Cosens, Technisches Laboratorium, Cambridge, England

Seite 132. ln 1087. Spalte 10 soll richtig lauten: 597.
Seite 151. ln 9883. Spalte 10 soll richtig lauten: 193.

Nach A. Steinhauser, *Hilfstafeln zur präzisen Berechnung zwanzigstelliger Logarithmen*:

Seite 144. ln 6343. Spalte 3 soll lauten: 33897.

Nach P. Gray, *Tables for the Formation of Logarithms* (Tafeln zur Bildung von Logarithmen)

Seite 133. ln 1409. Spalte 4 soll lauten: 21696.

Nach F. J. Duarte, *Nouvelles Tables Logarithmiques à 36 Décimales*
(Neue Logarithmentafeln auf 36 Dezimalen)

Seite 138. ln 3967. Spalte 6 soll richtig lauten: 91389.
Seite 145. ln 7247. „ 7 „ „ „ 25102.
Seite 149. ln 8837. „ 4 „ „ „ 42354.
Seite 149. ln 8963. „ 7 „ „ „ 38153.
Seite 150. ln 9623. „ 4 „ „ „ 83305.

Nach H. S. Uhler:

Seite 151. $\ln(1 - 9 \cdot 10^{-4})$ Die letzte Spalte soll lauten: 486.
7 „ „ „ „ „ 860.
5 „ „ „ „ „ 786.
2 „ „ „ „ „ 810.
1 „ „ „ „ „ 735.

$\ln(1 - 8 \cdot 10^{-5})$. „ „ „ „ „ 614.
6 „ „ „ „ „ 808.
5 „ „ „ „ „ 845.
4 „ „ „ „ „ 445.
3 „ „ „ „ „ 773.
1 „ „ „ „ „ 683.

$\ln(1 - 9 \cdot 10^{-6})$. „ „ „ „ „ 597.
8 „ „ „ „ „ 357.
7 „ „ „ „ „ 605.
5 „ „ „ „ „ 447.
1 „ „ „ „ „ 857.

Seite 152. $\ln(1 + 8 \cdot 10^{-4})$. „ „ „ „ „ 566.
5 „ „ „ „ „ 339.
1 „ „ „ „ „ 401.

$\ln(1 + 8 \cdot 10^{-5})$. „ „ „ „ „ 797.
5 „ „ „ „ „ 981.

Seite 152. $\ln (1 + 5 \cdot 10^{-6})$. „ „ „ „ „ 458.
1 „ „ „ „ „ 524.

$\ln 2$. Zeile 4, Spalten 11–13 sollen richtig lauten: 30070 95326 37.
$\ln 3$. „ 4 „ 11–13 „ „ „ 68975 60690 11.
$\ln 5$. „ 4 „ 11–13 „ „ „ 13580 59722 57.
$\ln 7$. „ 4 „ 11–13 „ „ „ 74183 10810 25.

Seite 156. $N = 31$. Die letzte Stelle soll lauten: 7.
$N = 43$. „ „ „ „ „ 4.
$N = 47$. „ „ „ „ „ 5.
Seite 157. $N = 59$. „ „ „ „ „ 6.
Seite 158. $N = 127$. „ „ „ „ „ 3.
$N = 227$. Spalte 12, lies 49565.
$N = 293$. Die letzte Stelle soll lauten: 4.
Seite 160. $N = 839$. Spalte 12, lies 53874.
$N = 1009$. Spalte 12, lies 38228.
Seite 161. $N = 1097$. Spalten 12–13, lies 00941 7.

Band II.

Nach A. D. Sollins, Küsten- und Landvermessung der Vereinigten Staaten

Auf S. 762, 38.°000 — 38.°050, soll in der Differenzenspalte für log tang und log cotg die dritte Stelle von links richtig lauten: 6, anstatt 7. So z. B. soll es in der ersten Differenz heißen: 156237, nicht 157237. Der Fehler erstreckt sich durch die ganze Spalte der Seite.

PROF. DR. J. PETERS

Ten-Place Logarithms

English Translations

by

CHARLES J. HYMAN

Volumes I, II, III

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VOLUME I

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Preface

This work comprises two volumes, of which the first contains the ten-place logarithms of the integers from 1 to 100000, the second those of the trigonometric functions of the 360 degrees of the circle at intervals of one-thousandth of a degree.

Its existence is due primarily to the fact that for scientific calculations of a basic nature Vegas Thesaurus logarithmorum no longer satisfies modern requirements with respect to purposiveness and reliability. Like Vlacqs Arithmetica logarithmica and Trigonometria artificialis, it is no longer available in the market. Recognizing this deeply felt deficiency, the well-known compiler and editor of other logarithm tables, Prof. Dr. J. Peters, by means of the necessary comprehensive calculations, had carefully prepared for publication a ten-place table, when the outbreak of the war placed in doubt the completion of his work sine die.

Even before the end of the war the Prussian Land Survey, on the occasion of a planned readjustment of its methods, again took up the idea, partly for its own needs but primarily for the needs of mathematical science in all its branches, of helping a basic work to arise again in perfect shape, the production of which was becoming more and more impossible for a private enterprise. In this project renowned scholars reinforced the authorities, which moreover, during the war, had at their command the collaboration of noted scientists. Therefore, the then Chief of the Prussian Land Survey, General of the Infantry Dr. V. Bertrab, convoked in 1917 a special commission for this work; besides Major General Launhardt (then Chief of the Trigonometric Division) and Regierungsrat Prof. Dr. Degner the members were: Geheimer Regierungsrat Prof. Dr. Karl Haußmann (Professor of Geodesy at the Berlin Polytechnic Institute), Prof. Dr. J. Peters (Observer at the Astronomical Computing Institute), and Dr. Karl Wirtz (Associate Professor at Kiel University). It turned out to the best advantage for the new table work, especially as to duration of its completion, that Prof. Dr. Peters put his above-mentioned, almost finished precomputations at the disposal of the Land Survey and could be won over for a responsible collaboration. The Peters computations provided for the decimal subdivision of the old nonagesimal degree, a method to which the Prussian Land Survey also had in the meantime considered giving preference for several reasons. Still, in view of the conflict of opinions it cannot be foreseen whether this decimal subdivision will become common practice; this can in no way detract from the value of the entire monumental table work.

In 1919 the second volume, the trigonometric part of the work could be published, together with a collection of auxiliary tables; the completion of the first volume, the numerical part and the appendix, because of the numerous difficulties (particularly in typesetting), could not be achieved until now.*

---

* On the basis of the present work the following books have also been published:
Seven-place Logarithm Tables } containing the logarithms of the trigonometric
Six-place Logarithm Tables } functions for every thousandth of a degree.
Berlin 1921. Published by the Printing Office of the Reich Office for Land Survey

The Reich Office for Land Survey in committing the completed work to the scientific world feels obligated to thank all the co-workers for their conscientious, expert and unselfish assistance, and to give special thanks to Prof. Dr. J. Peters as well as Dr. Johannes Stein (Permanent Assistant at the Berlin Polytechnic Institute) for the valuable mathematical tables in the appendix to volume I, and to Prof. Dr. Witt for a contribution to the Appendix, also to Oberregierungsrat Pfeiffer (present Chief of the Trigonometric Division of the Reich Office for Land Survey) for carrying out numerous auxiliary computations and for general promotion of the work. Thanks are due last but not least to all friendly advisers in the realm of German scholars, such as Geheimer Regierungsrat Prof. Dr., Dr.-Ing. h. c. L. Krüger, Prof. Dr. E. v. Hammer, Hofrats and Professors Dr. Schumann and Dr. Doležal and University Professor Dr. Johannes Frischauf.

May this work gain the satisfaction of all its users, in particular, of astronomers, geodesists and mathematicians.

Berlin, September 1922.

The Chief of the Reich Office for Land Survey
Weidner

Introduction

VOLUME I. The calculation of the ten-place logarithms as they appear in this volume, of all the integers from 1 to 100,000 is based upon a manuscript created in preparing for publication the eight-place logarithm tables by Bauschinger and Peters (*Logarithmisch-Trigonometrische Tafeln mit acht Dezimalstellen*: Leipzig, Wilhelm Engelmann, 1910); this manuscript gives the logarithms of the aforesaid integers accurately within one unit of the twelfth place. More detailed information as to the production of this manuscript, calculated from the original pioneer work of Briggs (*Arithmetica logarithmica*: London, 1624), can be found in the introduction to the above-mentioned eight-place tables. In order to obtain the tenth decimal of the logarithms accurately within a half unit, it sufficed in most cases merely to reduce to ten places the values in the twelve-place manuscript. However, it was necessary to investigate separately those logarithms in the manuscript ending in 49, 50 or 51 and therefore not admitting such a reduction to ten places free from objection, so as to arrive at the true value of the tenth decimal. All these doubtful logarithms were derived anew by the trigonometer Dittrich, Professor Peters and Dr. J. Stein, partly from the material in the tables by Steinhauser (*Hilfstafeln zur präzisen Berechnung zwanzigstelliger Logarithmen*: Wien, Carl Gerolds Sohn, 1880), partly by a new computation with the aid of the familiar logarithmic series:

$$\log\,(N+h) = \log N + 2M\cdot\left[\frac{h}{2N+h} + \frac{1}{3}\left(\frac{h}{2N+h}\right)^3 + \cdots\right],$$

where the required logarithm of the five-digit integer N, given on the right side, was determined from Steinhauser's and Callet's[1] values and the quantity h always assumed to be a single digit; besides, in order to ensure accuracy for every logarithm to be calculated, two distinct values were chosen for N and the appropriate values for h. This procedure led to a decision as to the digit in the tenth place in some instances not before the 15th or 16th decimal place, as for example in the case of the logarithms:

$$\begin{aligned}
\log\ 29888 &= 4.47549\ 68545\ 49999\ 3\\
\log\ 42244 &= 4.62576\ 50339\ 49999\ 8\\
\log\ 49295 &= 4.69280\ 28709\ 50004\ 9\\
\log\ 49692 &= 4.69628\ 64765\ 50002\ 9\\
\log\ 60757 &= 4.78359\ 63215\ 50007\ 5\\
\log\ 71734 &= 4.85572\ 50484\ 50003\ 4\\
\log\ 74281 &= 4.87087\ 77417\ 50006\ 8\\
\log\ 98053 &= 4.99146\ 08857\ 49995\ 5\cdot
\end{aligned}$$

Thus the logarithms of all numbers from 1 to 100,000 were derived accurately to a half unit of the tenth decimal.

---

[1] Callet, *Tables portatives de logarithmes:* Paris, Firmin Didot (1795) An 3e.

Everything now depended on obtaining an error-free printing of these original computations. This could be achieved only by a most careful reading of the galleys. After several preliminary proofreadings (done by a comparison with the manuscript and original computation) the proofsheets were subjected to a thorough difference check by adding every individual first difference to its attendant functional value and, besides, by forming the second-difference sequence to guarantee the first. Thus all table data, at least up to and including units of the tenth place, were well established. A meticulous comparison of this decimal with the aforementioned twelve-place tables, taking into consideration the new computations, further guaranteed the correctness of the printed logarithms to within a half unit of the last place. After that the composition was stereotyped and then, after these plates, the final proofs were read with scrupulous care; every heading and all the accessory material were again reviewed and the figures per se verified in the following manner: The first digits of the mantissa were compared with one of the leading seven-place tables and the eight-place table of Bauschinger and Peters to the seventh or eighth place; this comparison showed complete agreement among the tables. For the remaining digits the ten-place table of Vlacq (*Arithmetica logarithmica*: Gouda 1628) and a more recent American table ("Logarithms, their nature, computation and uses, with logarithm tables of numbers and circular functions to ten places of decimals," Part I, W. W. Duffield; Appendix No. 12 in *U. S. Coast and Geodetic Survey*, Report for 1896, Part II) were utilized. As was expected, a great many errors were found in Vlacq's tables. The comparison of the end digits with those of the American table seemed to be of greater importance, since these, according to the author's statement,[2] were based upon a completely new computation to the twelfth decimal. It was therefore all the more striking that here also an extremely large number of discrepancies were brought to light. Indeed it turned out that in most of the cases these discrepancies coincided with the errors found in Vlacq. Naturally all the logarithms that did not agree on comparison were subjected to a careful verification through a new computation; this showed that the American values without exception were erroneous. In the following, several discrepancies in the tenth decimal are noted:

Number	American Table	Vlacq	Vega	Recomputation	Errors in American Table
39 802	955	955	955	953.69	1.31
48 980	809	809	809	807.89	1.11
58 301	041	041	041	040.00	1.00
70 040	373	373	373	374.11	1.11
80 063	592	592	592	593.02	1.02
91 086	308	308	308	306.50	1.50
91 087	987	987	987	985.85	1.15

It is not strange that Vega's material (*Thesaurus logarithmorum completus*: Leipzig, 1794) agrees with Vlacq's, since, as Vega expressly states, the *Thesaurus* is merely an improved reprint of Vlacq's table. But it must cause amazement that the American author with his recomputation could produce in 267 instances the same erroneous logarithms as the *Thesaurus* contains. We leave to the reader the evaluation of this actual agreement of the American table with the *Thesaurus*.

[2] "... all the mantissae have been computed to twelve places of decimals, and whenever the eleventh and twelfth places exceeded 50 the tenth place has been increased by unity, or 1; but whenever the eleventh and twelfth places were 50 or less than that number the tenth place has not been increased."

On page XVI will be found a collection of all the errors (in the tenth place) of Vega's *Thesaurus*; a similar collection for the American table is unnecessary, since all the errors found therein are likewise contained in the *Thesaurus*.

Participating in the scholarly corrections were: Regierungsrat Kreuter, Professors Paetsch and Peters, Drs. Stein, Stracke, and Strehlow; thanks are due all of them for the great effort and care with which they dedicated themselves to the completion of a task requiring such trying and strenuous attention. Everything humanly possible was done to uncover every printing error, and hence it is to be hoped that this book can be offered error-free to the public.

Everything needed to understand the formation of the "Mathematical Tables" at the end of the first volume can be found in the explanations given with the individual tables.

Interpolation. To interpolate between table values, for a given argument, or vice versa, it is necessary to take into consideration, besides the first difference (d), also the pertinent second difference because d varies from interval to interval. One of the two following methods carrying out this interpolation is suggested: either interpolate first only with the table difference d in the usual way and then add to the result the "influence of the second difference" with the aid of the table on pages XIV and XV, so as to obtain the final interpolation value; or else, correct the first difference by using the "Tables Auxiliary to the Ten-Place Logarithm Tables" and then interpolate in the customary manner using the corrected first difference. In this connection it suffices in considering the second difference to take only three decimals of the phase, *i.e.*, the fractional part of the table interval for which the table values are to be interpolated. A few examples will illustrate these methods.

Example 1. Find log 17.273 47319 ,

P. 56 gives:

$$\log 17.273 = 1.237\ 3677\ 730\ \begin{matrix} 251\ 437 \\ 251\ 423 \end{matrix}\ (14).$$

The number 14, in parenthesis, is the second difference, that is the difference between the two first differences enclosing the logarithm.

Method 1.

$$\log 17.273 = 1.237\ 3677\ 730 \quad \text{(table logarithm)}$$

$$\text{phase } 0.47319 \times \text{table difference } 251\ 423 = \underline{\qquad 118\ 970_8}$$

$$1.237\ 3796\ 700_8$$

$$\left.\begin{matrix}\text{influence of second difference (see page XIV)} \\ \text{for } 0.473 \text{ and second difference } 14\end{matrix}\right\} = \underline{\qquad + 1_7}$$

$$\log 17.273\ 47319 = 1.237\ 3796\ 703$$

Method 2.

Table difference = 251 423

Corrected first difference (see Auxiliary Tables p. 4) for phase 0.47 and second difference 14 = + 4

corrected difference = 251 427

log 17.273 = 1.237 3677 730 (table logarithm)

phase 0.47319 × corrected difference 251 427 = 118 973

log 17.273 47319 = 1.237 3796 703

Example 2. *Given* log x = 1.237 3796 703. *Find* x.

P. 56 gives:

log 17.273 = 1.237 3677 730 (251 437 / 251 423) (14),

where (14) denotes the second difference.

Given: log x = 1.237 3796 703

difference = 118 973, divided by

the table difference = 251 423, gives

the phase approximation = 0.473.

Method 1.

Given: log x = 1.237 3796 703

Influence of the second difference for phase 0.473 and second difference 14 = -1_7

$1.237\ 3796\ 701_3$

log 17.273 = 1.237 3677 730 (table logarithm)

$118\ 971_3$, divided by

table difference 251 423, gives

0.473 19, hence antilogarithm

x = 17.273 47319.

Method 2.

Table difference = 251 423

correction for phase 0.47 and second difference 14 (cf. Auxiliary Table) = + 4

corrected difference = 251 427

above difference = 118 973, divided by

corrected difference 251 427, gives

0.47 319, hence

x = 17.273 47319.

VOLUME II. The table by Briggs-Gellibrand, *Trigonometria britannica*: Gouda 1633, serves as a basis for the calculation of logarithms of trigonometric functions. It furnishes the fourteen-place logarithms of sine and cosine for 0^0 to 45^0 at intervals of one-hundredth degree. In order to derive therefrom the table values for tenths of these intervals in the case of log cos, every fifth original value (i.e., interval $h = 0^0.05$) was taken to twelve places from Briggs-Gellibrand. A check on these values by forming the first to fourth differences

$$\Delta_1\left(a+\frac{1}{2}h\right), \quad \Delta_2(a), \quad \Delta_3\left(a+\frac{1}{2}h\right), \quad \Delta_4(a)$$

disclosed in the twelfth decimal an uncertainly of at most 0.6 of a unit (cf. the detailed discussion in the introduction to the eight-place logarithm table by Bauschinger and Peters). For interpolation to an interval $n = 50$ times as small, that is to $\frac{h}{n} = 0^0.001$, Bessel's interpolation formula

$$f(a+th) = f(a) + t\,\Delta_1\left(a+\frac{1}{2}h\right) + \frac{1}{2}t(t-1)\,\Delta_2\left(a+\frac{1}{2}h\right)$$
$$+ \frac{1}{6}t\left(t-\frac{1}{2}\right)(t-1)\,\Delta_3\left(a+\frac{1}{2}h\right) + \cdots$$

was utilized and terms of the third and of higher order were temporarily neglected. The first-difference sequence of the smaller interval begins with the value

$$d_1\left(a+\frac{1}{2n}h\right) = \frac{1}{n}\Delta_1\left(a+\frac{1}{2}h\right) - \frac{n-1}{2n^2}\Delta_2\left(a+\frac{1}{2}h\right)$$

and ends with

$$d_1\left(a+\frac{2n-1}{2n}h\right) = \frac{1}{n}\Delta_1\left(a+\frac{1}{2}h\right) + \frac{n-1}{2n^2}\Delta_2\left(a+\frac{1}{2}h\right):$$

the second difference has the constant value:

$$d_2\left(a+\frac{1}{n}h\right) = d_2\left(a+\frac{2}{n}h\right) = \cdots = d_2\left(a+\frac{n-1}{n}h\right) = \frac{1}{n^2}\Delta_2\left(a+\frac{1}{2}h\right)$$

These three values, to sixteen places, were determined for every interval and verified by means of the formula:

$$d_1\left(a+\frac{1}{2n}h\right) - d_1\left(a-\frac{1}{2n}h\right) = \frac{1}{n^2}\Delta_2(a) - \frac{n-1}{4n^2}\Delta_4(a)$$

Then, by adding together the first- and second-difference sequences, the desired interpolated logarithms of the cosine were obtained, wherein the retention of the four additional decimals, on the one hand acted as a safeguard against errors in rounding off, and on the other hand made possible a valuable sum check.

The calculation of the table values for log sin could not be carried out uniformly for the entire range from 0^0 to 45^0 but rather the following method was used: For the first five degrees an immediate interpolation was not possible; therefore the auxiliary quantities

$$S = \log \sin x^0 - \log x^0$$

were determined to 12 decimals from the Briggs-Gellibrand values ($0^0.05$ to $0^0.05$) by subtraction, and then the same interpolation process as above was carried out (cf. the 10-place reprint in "Tables Auxiliary to the Ten-Place Logarithm Table"). By adding the logarithm of the degree number (from Briggs) the requiredvalues of log sin were thus found. The remaining table values of log sin, from 5^0 to 45^0, were calculated in the same way as in the case of log cos; for the ranges 5^0 to $11^0.5$, $11^0.5$ to 17^0, 17^0 to 23^0, 23^0 to 30^0, 30^0 to 45^0, the values $n = 10, 20, 30, 40, 50$, respectively, were chosen. Decisive for this mode of division was the magnitude of the third difference, which had to be so small that the tenth decimal would not be affected too much, and thus, in neglecting this difference, the intended accuracy to a unit of the tenth decimal would not be disturbed. For this reason the third term of the interpolation formula was actually calculated in the range 5^0 to 6^0 and added to every logarithm.

The logarithms of the tangent function (log tg) were calculated in a wholly analogous manner as those of the sine, only the initial log tg had to be determined from Briggs-Gellibrand by subtraction (twelve-place), and for the subsequent interpolation, instead of S, the corresponding values

$$T = \log \operatorname{tg} x^\circ - \log x^\circ$$

were used (cf. the Ten-Place reprint in the "Tables Auxiliary to the Ten-Place Logarithm Tables").

With the computations indicated above, we achieved a self-contained, completely new twelve-place logarithm table of the trigonometric functions sin, cos, tg of all angles from 0^0 to 45^0 at intervals of $0^0.001$. Although here the tenth decimal was still not assured correct to a half unit which, according to the design of the entire work for purposes of only an eight-place table, was not attainable without considerably more work, the interpolated twelve-place values were nevertheless rounded-off to ten places and appear in this form in the second volume of these tables. The uncertainty in these values can in no case amount to as much as one unit in the tenth decimal.[3] This assertion is confirmed further by the fact that a comparison of this table with the work of Andoyer (*Nouvelles tables trigonometriques fondamentales*: Paris, 1911) disclosed no deviation of over a unit in any of the 5400 items common to both (each 25th value of the decimal division). Among the logarithms common to both works were found:

one with the deviation 0.82 units in the tenth decimal
one with the deviation 0.80 units in the tenth decimal
29 with a deviation between 0.8 and 0.7 units in the tenth decimal
79 with a deviation between 0.7 and 0.6 units in the tenth decimal
108 with a deviation between 0.6 and 0.5 units in the tenth decimal
5182 with a deviation less than a half unit in the tenth decimal.

[3] It is to be noted that the values in the tables "Seven-Place Logarithms of Trigonometric Functions" and "Six-Place Logarithms of Trigonometric Functions" (both reprints from the Ten-Place Tables, vol. 2) can be and are guaranteed exact to a half unit of the last place.

Moreover, in using the table the interpolated logarithms would achieve very little in the way of accuracy even if the tenth decimal were guaranteed to a half unit; the theoretical uncertainty merely goes down from $1\frac{1}{2}$ to $1\frac{1}{8}$ units in the tenth decimal.

For printing purposes a ten-place manuscript was produced from the original computations; in this manuscript the missing logarithms of the cotangent were brought in as an arithmetical complement of the logarithms of the tangent. The proofreadings of the second volume of the ten-place tables and of the reprint therefrom in seven- and eight-place tables were, insofar as was feasible, done in mutual dependency.

Interpolation. On the carrying out of interpolation in the case of the logarithms of trigonometric functions, details and examples will be found in the introduction to the second volume.

J. T. Peters

Page XIV–XV

Einfluß der zweiten Differenz	Influence of second difference
Zweite Differenz	Second difference
Phase	Phase

Page XVI:

ERRATA

1. In Vegas Thesaurus the tenth decimal of the logarithms of the following numbers are erroneous:

(558)	(25586)	35053	48305	53139	62173	71764	77437	94649
(863)	(25707)	35298	48614	53647	62257	72103	77663	96981
(869)	(26004)	35779	48626	53868	62273	72298	77926	97674
10033	26407	(38051)	48845	54026	62933	72538	77944	98053
(11003)	26642	38277	48980	54040	63183	72675	78079	98336
(11240)	26699	38321	49047	54145	63357	73046	78259	98337
11699	26717	38783	49295	54273	63887	73059	79447	98338
(15620)	27291	39227	49409	54349	64086	73286	79467	98339
(17646)	27560	39802	50100	54419	64639	73303	79666	98340
(17647)	27586	39839	50211	54708	64993	73404	80060	98341
(17648)	27861	40108	50414	54825	65143	73441	80062	98342
(17649)	27921	40127	50601	55010	65185	73501	80063	98345
(20071)	28486	40966	50828	55115	65311	73570	80090	98346
(20280)	28680	41156	50937	55313	65659	73571	81212	98348
(20375)	29112	41227	50996	57089	65946	73655	81460	98350
(20645)	29226	41385	51037	57202	66125	74527	82951	98352
(20822)	29446	41947	51096	57486	66187	74723	82991	98353
(20866)	29639	42191	51141	57751	66239	74733	83693	98356
(21245)	29703	42584	51175	58081	66423	74932	83803	98357
(21749)	30502	42868	51299	58214	67399	74941	83967	98358
(21795)	30728	44021	51388	58223	69009	75149	85651	98359
(21904)	31001	44822	51389	58301	69311	75386	85810	98360
(22016)	31627	45060	51606	58477	69457	75395	86688	98362
(22200)	(31653)	45231	51607	58858	69477	75560	86708	98365
22312	31817	45238	51820	59007	69988	75562	86898	98366
(22877)	31919	45474	51915	59498	70019	75590	87634	98367
(22996)	32111	45549	52064	60401	70040	75613	89182	98772
(23274)	32633	45571	52533	60487	70043	75841	89185	98936
(23492)	32672	45697	52565	(60704)	70066	75953	90625	98966
(23820)	33370	45725	52587	60794	70599	76369	91086	99404
(24156)	34037	45755	52620	61011	71140	76519	91087	99926
24580	34664	46073	52792	61157	71306	76574	91801	
(25173)	34702	47162	52823	62038	71569	76683	93155	
(25524)	34734	47476	52986	62131	71653	77047	93498	

2. At the same places the same errors occur in the ten-place tables of Duffield; however, the logarithms of the numbers in parentheses (above) are correct.

3. In his work "Tabularum trias" Leber designates as erroneous Vegas logarithms of the eight numbers: 26188, 29163, 30499, 31735, 34162, 34358, 34664, 60096; actually, these are correct.

4. Ten-place Logarithm Tables, Vol. 1. P. 172: log 34664 = 4,539 8786 760.

5. Ten-place Logarithm Tables, Vol. II.

P. 17: for log sin $0^0.773$: d = 5614 32
18, for log sin $0^0.820$: d = 5292 69
22, for log sin $1^0.005$: d = 4318 75
85, for log sin $4^0.182$: d = 1036 515
478, log sin $23^0.844$ = 9.606 6476 821
756 log cotg $37^0.713$ = 0.111 6798 899
762 for log tang $38^0.000$ to log tang $38^0.049$: d = 156 237 to d = 156171.

Page

1	Zehnstellige Logarithmen der Zahlen 1 bis 1000	Ten-place logarithms of numbers 1 to 1000
7	Zehnstellige Logarithmen der Zahlen 10000 bis 100000	Ten-place logarithms of numbers 10000 to 100000

APPENDIX TO VOLUME I

Pages III—XVII

Among the numbers occurring frequently in mathematical research there are many which, despite their conceptual simplicity, are difficult to evaluate numerically. It therefore appeared advisable to recalculate these numbers and, with a view to the broadest applicability, make this computation to as many ensured decimal places as possible. Of course, in view of the extensive computation work involved only a limited selection of suitable numbers could be included. It was considered advisable to give in connection with these tables essentially only such quantities as are intimately related to logarithmic, trigonometric and logarithmic-trigonometric series.

In studying the pertinent literature it appeared that the published items were not always correct and did not hold out any guarantee that our required degree of accuracy of a half unit in the last decimal was fulfilled. Therefore we computed afresh all the numbers set forth herein. Even in the few cases where the recomputation of the published items to the last decimal would have required an unreasonable length of time and hence was left undone, as, for example, in the case of π to 707 places, nevertheless the values were recalculated to about 50 or 60 places and the additional decimals taken over from the authors in question after the application of appropriate checks. Thanks are due Professor Goldscheider and Dr. A. Grimpen for several minor contributions.

The following contains for each table an accompanying explanation which shows the genesis and the checks employed, insofar as they seemed to be required for an understanding of the connection and the evaluation of the constants in question.

TABLE 1. (pp. 1–12)

Table 1 gives the mathematical constants π, e, M, C as well as certain numerical values derived from them, such as multiples, reciprocals, powers, logarithms. Here is the way the table was formed and calculated:

1. The number π, the ratio of the circumference of a circle to its diameter, was recalculated to 64 places by means of the formula

$$\pi = 32' \operatorname{arc\,tg} \frac{1}{10} - 4 \operatorname{arc\,tg} \frac{1}{239} - 16 \operatorname{arc\,tg} \frac{1}{515}$$

and, to that many places, found to be in agreement with the published value. The places beyond the 64th, which are given in Table 1 to the 707th, were taken from the paper by W. Shanks "On the extension of the numerical value of π" (*Proceeedings of the Royal Society of London*: vol. XXI, 1873), wherein Shanks utilizes the formula

$$\frac{\pi}{4} = 4 \operatorname{arc\,tg} \frac{1}{5} - \operatorname{arc\,tg} \frac{1}{239}$$

and the required values $\operatorname{arc\,tg} \frac{1}{5}$ and $\operatorname{arc\,tg} \frac{1}{239}$ are given separately for each to 709 places. As a matter of fact, the combination of both values showed deviations for π in the decimal places 74, 75, 460–462, 513–515; we obtained there 70, 962 and 065 as against Shank's values of 86, 834 and 193.

In the case of the first deviation the reading 86 is evidently correct, since Vega in the *Thesaurus logarithmorum* arrived at the same group of figures. independently of Shanks,

by two different methods of computation. We need only substitute 8 for 7 in the 75th place in Shank's computation of arc tg $\frac{1}{5}$, in order to obtain Vega's result. As to the other two discrepancies no decision can be made without a recomputation; they disappear if in the Shank's value of arc tg the 462nd place is diminished by 8 and the 515th increased by the same amount. Such an artificial change seems however to be untenable because of its improbability. It is more likely that the figures 962 and 065, respectively, are correct.[4]

The constants $\frac{1}{\pi}$, $\sqrt{\pi}$, $\frac{1}{\sqrt{\pi}}$, $\log \pi$, $\ln \pi$, e^{π}, $e^{-\pi}$, $e^{\frac{\pi}{4}}$, $e^{-\frac{\pi}{4}}$, $\sqrt{2}$ and $\sqrt{3}$, some of which were computed by Professor Goldscheider, require no special comment.

Apart from the first 9 multiples of π, $\frac{1}{\pi}$, $\log \pi$, $\ln \pi$ (to 32 places), there follow the first 32 powers of π (to 32 significant digits), which were obtained successively by multiplication by π, and then checked thoroughly as follows: the even powers alone were determined a second time from π^2 through continued multiplication by π^2; besides, the sum of the odd and that of the even powers were verified by the sum formula for geometric series and the last power π^{32} was determined once more, by repeated squaring in the shortest way through the 2nd, 4th, 8th and 16th powers. The same procedure was used in calculating the powers of $\frac{1}{\pi}$. On the constant C, see p. XVI.

The values of the first hundred multiples of arc $1^0 = \frac{\pi}{180}$, arc $1' = \frac{\pi}{10800}$, arc $1'' = \frac{\pi}{648000}$, as well as $1^{gr} = \frac{\pi}{200}$ (a new subdivision), appearing on pp. 3–6 to 32 places, were found successively by summation and assured in the last places by taking into account additional decimals. The 100th value naturally agreed digit-wise with the initial value.

2. The numbers M (Brigg's modulus) and $\frac{1}{M}$ (given in detail in the 52-place tables of Peters and Stein)[5] were determined ab initio to 65 decimals. The additional places, to 282, were taken from the paper by. J. C. Adams "Note on the value of Euler's Constant; likewise on the values of the Naperian logarithms of 2, 3, 5, 7, and 10, and of the Modulus of common logarithms, all carried to 260 places of decimals". (*Proceedings of the Royal Society of London*: vol. XXVII, 1878).

The Briggs logarithm of M was determined[5] in two different ways: through multiplication by $\frac{1}{M}$ we obtained the 50-place natural logarithm of M in agreement with the 54-place table value of ln M of Professor Goldscheider, to whom are due also all the following first 32 powers of M (32 decimals) and of $\frac{1}{M}$ (32 digits). Appropriate checks guarantee their accuracy.

3. The first hundred multiples of the values M and $\frac{1}{M}$ on pp. 8–11 enable us to convert natural to ordinary logarithms, and conversely. Taking into account the 61-place logarithms

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[4] This conjecture was verified subsequently by a note of Shanks in *Proceedings of the Royal Society:* vol. 22 (45). The value of π in the text is corrected accordingly.

[5] *Zweiundfünfzigstellige Logarithmen*, No. 43 of the Veröffentlichungen des Astronomischen Rechen-Instituts, Berlin.

in Callet (here Table 14b) we have given them to 61 places and ensured their accuracy in the same way as above (cf. 1.) by actual checks (also in respect to the last digits).

4. The 72-place value of the natural base[6]

$$e = 1 + \frac{1}{1!} + \frac{1}{2!} + \frac{1}{3!} + \cdots$$

together with the values of $\frac{1}{e}$, $\sqrt{e}$, $\frac{1}{\sqrt{e}}$, were calculated by Prof. Goldscheider and checked among other methods, by the equations: $e \cdot \frac{1}{e} = 1$, which gave $1 - 2.10^{-72}$ instead of 1, and $\left(\sqrt{e} + \frac{1}{\sqrt{e}}\right)\left(\sqrt{e} - \frac{1}{\sqrt{e}}\right) = e - \frac{1}{e}$, where, as it happened, both sides agreed to 72 decimals. Our recomputation to 52 decimals (cf. p. 60) confirmed Goldscheider's values of e and $\frac{1}{e}$. As we learned afterwards (from Dr. Karl Blum), the values of e and $\frac{1}{e}$, each to 105 places, already existed in Grunert's *Archiv*, vol. III, p. 28; for e the places 71 to 105 are:

→ e: ... 30353 54759 45713 82178 52516 64274 27466

and for $\frac{1}{e}$:

→ ... 95744 89980 33571 47274 34591 96437 46627;

Comparison with the Goldscheider values gave an agreement in the case of $\frac{1}{e}$, whereas there was a discrepancy of two units in the last place of e. Our text contains the Goldscheider value of e, increased by two units.

The powers of e (32 significant digits) and $\frac{1}{e}$ (32 places) were obtained in a similar fashion and checked like the corresponding powers of π and $\frac{1}{\pi}$ (cf. 1.); only the sum checks for the odd and even powers of e were necessarily omitted for obvious reasons.

TABLE 2 (pp. 13–35)

Tables 2a furnish (pp. 13–31) the first ten powers $N, N^2, N^3, \ldots, N^{10}$ of all the integers N from 2 to 308 inclusive. In calculating them by repeated multiplication, the accuracy of the tenth table value N^{10} was verified in each case through the summation formula:

$$N + N^2 + \cdots + N^9 = \frac{N^{10} - N}{N - 1}$$

Beyond the tenth powers, Tables 2b (pp. 32–35) give adequate information. These contain the powers to every prime number p under 100 for all integral exponents less than $\frac{32}{\log p}$ and the more frequently occurring powers of 2, 3 and 5 within a still greater range, namely to the 120th, 70th and 60th order, respectively. To check their correctness the summation formula for geometric series was utilized in the same way as above.

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[13] [6] To 346 places by J. M. Boorman, *Mathematics* magazine, vol. 1, No. 12, p. 204.

TABLE 3 (p. 36–57)

Table 3 contains the consecutive reciprocal powers $\frac{1}{N}, \frac{1}{N^2}, \frac{1}{N^3}, \ldots$ of all the integers N from 2 to 100 accurate to 32 places. The exponents are less than $\frac{32}{\log N}$.

For this calculation it suffices to repeatedly divide the initial number $\frac{1}{N}$ by N and check by adding up the individual values and comparing their sum with the test value $\frac{1}{N-1}$. Besides, the last place of each power was verified through multiplication by N in reverse order and found correct.

TABLE 4, (pp. 58–59)

In respect to the values of the 60 factorials $n! = 1.2.3 \ldots n$ (Table 4a, p. 58) and their decomposition into prime factors (Table 4b, p. 59) it is merely noted that their calculation was carried out for each case independently through multiplication successively by $2, 3, 4 = 2^2$, etc. to $60 = 2^2 . 3 . 5$. The individual values thus found were, conversely, determined from the final value 60! through division by 60, 59, 58..., to 3 once more. Besides, as a final check, the 60th decomposition was multiplied out and the result was 60! exactly. (For a further check, see Table 7, p. VIII.)

TABLE 5 (p. 60)

The division of $\frac{1}{n!}$ by $(n + 1)$ for $n = 1,2,3 \ldots, 42$ yielded the successive reciprocal factorials $\frac{1}{2!}$ to $\frac{1}{43!}$, given in Table 5. As a check every individual result was again reduced to the preceding $\frac{1}{(n-1)!}$ through multiplication by the corresponding n and thus ensured to $\frac{1}{2}$ unit in the 54th decimal. At the foot of the page will be found the following numerical values obtained by the algebraic addition of the table items:

$$e = 1 + \frac{1}{1!} + \frac{1}{2!} + \frac{1}{3!} + + \cdots$$

$$\frac{1}{e} = 1 - \frac{1}{1!} + \frac{1}{2!} - \frac{1}{3!} + - \cdots$$

$$\sin 1 = 1 - \frac{1}{3!} + \frac{1}{5!} - \frac{1}{7!} + - \cdots$$

$$\cos 1 = 1 - \frac{1}{2!} + \frac{1}{4!} - \frac{1}{6!} + - \cdots$$

$$\operatorname{sh} 1 = 1 + \frac{1}{3!} + \frac{1}{5!} + \frac{1}{7!} + + \cdots \text{[6a]}$$

$$\operatorname{ch} 1 = 1 + \frac{1}{2!} + \frac{1}{4!} + \frac{1}{6!} + + \cdots$$

It should be noted also that the summation for e and $\frac{1}{e}$ gave the final figures (beginning with the 51st decimal) 9574 and 7834 instead of the correct values 9575 and 7835, given on p. 12, thus giving a further, even if only a summary, check of the numbers there. All

[6a] The hyperbolic functions sh and ch are often denoted by Sin, Cof.

six values were compared further with those given in Grunert's *Archiv* vol. 3, p. 28 and found to be in agreement therewith. According to this source, the 51st to 105th places read:

for sin 1: 10656 72751 70999 19104 04391 23966 89486 39743 54305 26958 54349,
for cos 1: 22276 70097 25538 11003 94774 47176 45179 51856 08718 30893 43571.
for sh 1: 58702 29565 41301 33075 67304 32389 56071 17452 08962 33918 40419.
for ch 1: 37047 37402 21471 07690 63049 22369 89642 64726 43554 30355 87046.

TABLE 6 (pp. 61–68)

Table 6 contains eighteen-place logarithms of the first 1200 factorials. Even though the calculation of the individual values appeared quite easy—we needed only to add successively the 21-place logarithms of the numbers 2,3,...to 1200 from Steinhauser's table—nevertheless a certain care was required by reason of the use of the non-errorfree Steinhauser tables. As a check on the Steinhauser values and the correct carrying out of the summation, every 50th table value was calculated, independently of the rest, directly by means of Stirling's semi-convergent series[6b]

$$\log n! = \frac{1}{2}\log 2\pi + \left(n + \frac{1}{2}\right)\log n - n\,M + M\left(\frac{B_1}{1\cdot 2\cdot n} - \frac{B_2}{3\cdot 4\cdot n^3} + \frac{B_3}{5\cdot 6\cdot n} - + \cdots\right)$$

where $\frac{1}{2}\log 2\pi = 0.39908\ 99341\ 79057\ 52$ and M denotes the modulus (see p. 7), B_1, B_2, ... the Bernoulli numbers (Table 8, p. 83). As none of the checked values was in error by more than one unit in the 20th decimal, it was certain that the intermediate values were correct within a half unit of the 18th decimal. In order to be sure of the intermediate values, and to avoid the errors which, though highly improbable, still always lie in the realm of possibility in the addition of compensating errors, all the table values were compared most carefully with the items in C. F. Degen's *Tabularum Enneas*: Havniae, 1824, whereby, except for some printing errors in Degen, there were disclosed only discrepancies in the last decimal amounting to at most one unit. Thus all table items are sufficiently ensured.

TABLE 7 (pp. 69–82)

The table gives the numerical values and prime factors of the binomial coefficients $\binom{n}{0}, \binom{n}{1}, \binom{n}{2}, \ldots, \binom{n}{k}, \ldots, \binom{n}{n}$ to every integral base n from 1 to 60. For every table value there are 2 indices, index k (left columns) and index n — k (right columns), for which the binomial coefficients are equal. Between the items of successive subtables there subsists the relation of the so-called Pascal triangle:

$$\binom{n+1}{k} = \binom{n}{k} + \binom{n}{k-1}; \quad \binom{n}{0} = 1.$$

The (unfactored) coefficients (Table 7a, pp. 69–74) are found by this law and verified by forming the sums $\binom{n}{0} + \binom{n}{1} + \binom{n}{2} + \ldots + \binom{n}{n} = 2^n$. Independently thereof, the binomial

[6b] Special case of Euler's summation formula mentioned below (page XI). The remainder of the series (the error) is less then the last term used of the series.

coefficients in factored form (Table 7b, pp. 75–82) were obtained from the multiplication of unity and of the individual results successively by $\frac{n}{1}, \frac{n-1}{2}, \frac{n-2}{3}, \ldots$; here the check consisted in the fact that in every instance the final item $\binom{n}{n/2}$ in the subtable with even base n could differ from the last item in the preceding subtable only by the factor 2. Furthermore the evaluation of the products in the 6 subtables $\binom{10}{k}, \binom{20}{k}, \binom{30}{k}, \ldots, \binom{60}{k}$ yielded again the appropriate unfactored values. Finally the last coefficient $\binom{60}{30}$ of $\frac{60!}{(30!)^2}$ was derived after the items in Table 4b and thus a mutual check of both tables was achieved.

Remark. The logarithms of the binomial coefficients can be readily calculated from the formula $\log \binom{n}{k} = \log n! - \log k! - \log (n-k)!$, with $0! = 1$, by using Table 6.

TABLES 8 and 9 (pp. 83–89)

These tables furnish the practical computer with the information most needed concerning the Bernoulli and related numbers which appear repeatedly in general series developments. In Table 8 we find (pp. 83–87) the first 90 Bernoulli numbers B_1 to B_{90}, which we have taken from the work of S. Sérébrennikov, *Tables des premiers quatre-vingt-dix-neuf*[7] *nombres de Bernoulli*, 1905 (Mémoires de l'académie impériale des sciences de St. Pétersbourg, VIIIth Series, Tome VI, Nr. 10), and in Tables 9a (p. 88) and 9b (p. 89) the tangent numbers T_1 to T_{30} and the secant numbers (Euler's numbers) E_1 to E_{30}. In connection therewith are given: the 10-place logarithms of B_1 to B_{250}, T_1 to T_{50} and E_1 to E_{50}, also the ratios $\frac{B_n}{B_{n-1}}$, $\frac{T_n}{T_{n-1}}$ and $\frac{E_n}{E_{n-1}}$. The above-mentioned numbers are the coefficients in the series:

$$\operatorname{ctg} x = \frac{1}{x} - \frac{2^2 B_1}{2!} x - \frac{2^4 B_2}{4!} x^3 - \frac{2^6 B_3}{6!} x^5 - \cdots . \qquad 0 < |x| < \pi$$

$$\operatorname{tg} x = T_1 x + T_2 \frac{x^3}{3!} + T_3 \frac{x^5}{5!} + T_4 \frac{x^7}{7!} + \cdots . \qquad |x| < \frac{\pi}{2}$$

$$\sec x = 1 + E_1 \frac{x^2}{2!} + E_2 \frac{x^4}{4!} + E_3 \frac{x^6}{6!} + \cdots . \qquad |x| < \frac{\pi}{2}$$

We checked these numbers in the following way:

By means of the formula

$$T_n = \frac{2^{2n}(2^{2n}-1)}{2n} B_n \qquad n = 1, 2, 3 \cdots$$

we determined the tangent numbers T_1 to T_{30} from the corresponding Bernoulli numbers B_1 to B_{30} and checked them first by the recursion formula for tangent numbers:

$$\binom{2n-1}{1} T_1 - \binom{2n-1}{3} T_2 + \binom{2n-1}{5} T_3 - + \cdots - (-1)^n T_n = 1 .$$

applied to the case $n = 30$. Thus the T-numbers were guaranteed. Of the secant numbers

[7] Despite the title, only 90 numbers are given there.

(Euler's numbers) we were able to extract the first 27 from Glaisher's work: On Eulerian numbers (*Quarterly Journal of Pure and Applied Mathematics*, vol. 45, London, 1914), whereas the 28th, 29th and 30th were calculated by us from Glaisher's formula

$$E_n - \binom{n}{2} 10^2 E_{n-1} + \binom{n}{4} 10^4 E_{n-2} - + \cdots = 25^n - 2(21^n - 9^n)$$

As a check we applied to the case n = 30 the recursion formula

$$\binom{2n}{2} E_1 - \binom{2n}{4} E_2 + \binom{2n}{6} E_3 - + \cdots - (-1)^n E_n = 1,$$

which was actually satisified by the Euler numbers, thus ensuring their correctness.

In order to verify still further the T and E values so obtained, they were mutually ensured by means of the formulas

$$\binom{2n}{1} T_1 - \binom{2n}{3} T_2 + \binom{2n}{5} T_3 - + \cdots = 1 - (-1)^n E_n \quad \text{and}$$

$$\binom{2n}{1} E_1 - \binom{2n}{3} E_2 + \binom{2n}{5} E_3 - + \cdots = (-1)^{n+1} T_{n+1},$$

applied to the cases n = 30 and 29 respectively; these formulas express a relationship between the tangent- and secant numbers.

Thus not merely the tangent- and secant numbers, but also simultaneously the first 30 Bernoulli numbers, the basis adopted for the calculation of the tangent numbers, were verified as correct. For the remaining Bernoulli numbers B_{31}, to B_{90} we had to be satisifed with a less thorough check, one which was based on the determination of the remainders for mod. 7, 9, 11, 13. If p_n is the numerator, q_n the corresponding relatively prime denominator of the nth Bernoulli number B_n, then there subsists the relationship, already mentioned:

$$n q_n T_n = 2^{2n-1}(2^{2n} - 1) p_n$$

between the nth tangent- and the nth Bernoulli number. The moment we succeeded in establishing the remainders of the 31st to 90th tangent numbers for the said moduli without having to calculate the tangent numbers themselves, a joint remainder check on the numerators and denominators of the questionable Bernoulli numbers could be undertaken. This was in fact possible. As we know, the remainders of the Euler numbers for prime moduli recur periodically (cf. Glaisher, loc. cit.); for the moduli 7, 9, 11, 13, the remainders are:

1,	5,	5,	6,	2,	2	1,	5,	5, ···				(mod. 7),
1,	5,	7,	8,	4,	2	1,	5,	7, ···				(mod. 9),
1,	5,	6,	10,	9,	10,	6,	5,	1,	2	1,	5, ···	(mod. 11),
1,	5,	9,	7,	3,	0	1,	5,	9, ···				(mod. 13).

This circumstance suggests seeking a similar periodicity in the case of the tangent numbers, which, as we know, satisfy almost the same recursion formulas as the Euler numbers and besides occur with these in the development of

$$\operatorname{tg}\left(\frac{\pi}{4} + \frac{x}{2}\right) = 1 + T_1 x + E_1 \frac{x^2}{2!} + T_2 \frac{x^3}{3!} + E_2 \frac{x^4}{4!} + \cdots$$

In fact, for the first 30 tangent numbers a periodicity was disclosed in the following remainders

for mod 7: 1, 2, 2, 6, 5, 5 | 1, 2, 2, ···
for mod 9: (1), 2, 7 | 2, 7 | 2, 7 | ···
for mod 11: 1, 2, 5, 8, 5, 10, 9, 6, 3, 6 | 1, 2, ···
for mod 13: 1, 2, 3, 12, 6, 10 | 1, 2, 3, ···

As a consequence we have inferred a like periodic behavior of the tangent numbers beyond T_{30}. Thus the remainders for these numbers to any order were established, and there resulted a complete agreement between the right and left sides of the above formula as to the remainders. Herewith we have carried out, we believe for the first time, a decisive, comparatively simple check of the Bernoulli numbers.[8]

It will be further observed that the determination of the remainder in the case of numbers with many places, such as the numerators of Bernoulli's numbers, can be accomplished for the moduli 7, 9, 11, 13 most simply as follows: Divide up the given number from right to left into groups a. $10^5 + b.10^4 + c.10^3 + d.10^2 + e.10 + f$ for every 6 digits a, b, c, d, e, f and form the sum $A.10^5 + B.10^4 + C.10^3 + D.10^2 + E.10 + F$ of these groups. Then the remainder of the number at hand is

for 7 equal to that of $5A + 4B + 6C + 2D + 3E + F$.
for 9 equal to that of $A + B + C + D + E + F$,
for 11 equal to that of $10A + B + 10C + D + 10E + F$,
for 13 equal to that of $4A + 3B + 12C + 9D + 10E + F$.

The ten-place logarithms of the three aforesaid number groups (even for higher ordinals n than in the numerical part) in the case of the Bernoulli numbers were taken from the paper by J. W. L. Glaisher (Trans. Cambridge Philosophical Soc., vol. XII, Cambridge, 1873; Tables of the first 250 Bernoulli Numbers [to nine figures] and their logarithms [to ten figures]), while those of the tangent- and Euler numbers to the fifteenth were found directly from the antilogarithm, but beyond the fifteenth by means of the formulas

$$T_n = (2n-1)!\,2\left(\frac{2}{\pi}\right)^{2n}\cdot\left(1+\frac{1}{3^{2n}}+\frac{1}{5^{2n}}+\cdots\right),$$

$$E_n = (2n)!\,2\left(\frac{2}{\pi}\right)^{2n+1}\cdot\left(1-\frac{1}{3^{2n+1}}+\frac{1}{5^{2n+1}}-\cdots\right)$$

($n = 1, 2, 3, \ldots$), wherein, moreover (for $n > 15$) the logarithm of the right side of the series had no longer any influence on the tenth decimal, and hence did not need to be taken into account.

A repeated computation using various aids gave this part also the required certainty.

TABLE 10 (pp. 90–94)

The tables contain the various sums, which do not lend themselves to direct computation, of the reciprocals of the nth powers of the natural or the even or the odd numbers taken with the same or alternating signs, for successive values of n exact to 32 decimals. As to the extensive computation required for obtaining and checking them, we state briefly

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[8] A further check is possible by means of the V. Staudt-Clausen theorem: If we denote by $a - 1$, $b - 1$, ..., in turn, those divisors of 2n (unity and 2n also being regarded as divisors) which, when increased by 1, are prime, then the proper fraction contained in the nth Bernoulli number B_n equals that of $N + (-1)^n\left(\frac{1}{a}+\frac{1}{b}+\frac{1}{c}+\cdots\right)$, where N is an appropriate natural number.

only the following: All sums for which $n \geq 32$ were directly composed from their individual terms by using Table 3. As to the smaller exponents n (below 32), since this additive process practically did not lead to the goal,[9] it was necessary to apply other, and in fact distinct, methods according as n was even or odd. For part of the desired sums the formulas.

$$\zeta_{2\nu} = 1 + \frac{1}{2^{2\nu}} + \frac{1}{3^{2\nu}} + \frac{1}{4^{2\nu}} + \cdots = \frac{2^{2\nu-1} \cdot \pi^{2\nu}}{(2\nu)!} B_\nu$$

and

$$\eta_{2\nu+1} = 1 - \frac{1}{3^{2\nu+1}} + \frac{1}{5^{2\nu+1}} - + \cdots = \frac{\pi^{2\nu+1}}{2^{2\nu+2}(2\nu)!} E_\nu$$

($n = 1, 2, 3, \ldots$; B_n the Bernoulli, E_n the Euler numbers) were utilized; and the required multiplications and divisions on the right carried out in two different ways so as to ensure their correctness. Since for the remaining sums, *i.e.*, for the still missing values $\zeta_3, \zeta_5, \ldots$ as well as $\eta_2, \eta_4, \ldots$, closed expressions lending themselves to computation are not known within the extent of our knowledge, and on the other hand direct computation does not practically get us anywhere —for example, the calculation of Catalan's constant

$$\eta_2 = 1 - \frac{1}{3^2} + \frac{1}{5^2} - \frac{1}{7^2} + - \cdots$$

to 32 decimals would in fact require more than 5.000 trillion terms—we must look to other means. It seemed a good idea to make use of the following semi-convergent expansions:[10]

$$(1) \quad f(a) + f(a+h) + f(a+2h) + \cdots + f(b) = \frac{1}{h}\int_a^b f(x)\,dx + \frac{f(a)+f(b)}{2}$$
$$- \frac{B_1}{2!} h\,[f'(a) - f'(b)]$$
$$+ \frac{B_2}{4!} h^3\,[f'''(a) - f'''(b)]$$
$$- \frac{B_3}{6!} h^5\,[f^{(5)}(a) - f^{(5)}(b)]$$
$$+ \cdots\cdots\cdots\cdots \quad \text{and}$$

$$(2) \quad f(a) - f(a+h) + f(a+2h) - f(a+3h) + \cdots \pm f(b) = \frac{1}{2}\left[f\left(a - \frac{h}{2}\right) \pm f\left(b + \frac{h}{2}\right)\right]$$
$$- \frac{E_1}{2!\,2^3} h^2 \left[f''\left(a - \frac{h}{2}\right) \pm f''\left(b + \frac{h}{2}\right)\right]$$
$$+ \frac{E_2}{4!\,2^5} h^4 \left[f^{(4)}\left(a - \frac{h}{2}\right) \pm f^{(4)}\left(b + \frac{h}{2}\right)\right]$$
$$- \cdots\cdots\cdots\cdots$$

in formula (2), where the double sign $\pm$ appears, we are to employ throughout either the upper or the lower sign according as the sign of f (b) on the left is plus or minus; the coef-

[9] With certain exceptions.

[10] The remainder of series (1) will be less than the numerical value of the last-used term $B_n \cdot [\ ]$, and likewise the remainder of (2) less than the expression resulting from the last term $E_n \cdot [\ ]$, by taking the lower sign (—) if in (1) the sign of the $2n^{th}$ derivative of f (x) does not change in the interval [a, b], and in (2) the sign of the $(2n+1)^{st}$ derivative does not change in the interval $\left[a - \frac{h}{2}, b + \frac{h}{2}\right]$.

ficients B_n and E_n denote the Bernoulli (B) and Euler (E) numbers, respectively. It should be mentioned that the first of these summation formulas is known as the Euler-Maclaurin formula, while the second, though discovered independently by Dr. Stein, had already been given by Schlömilch, at least in principle, as became apparent after all our computation was finished. (Grunert's *Archiv*). To our knowledge no practical use has ever been made of the results stated there, although the second formula may serve us well in many related cases and speedily yields the desired result; for example, the use of Leibniz's series

$$\frac{\pi}{4} = 1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + - \cdots,$$

as it stands, to compute $\frac{\pi}{4}$ to 5 places, would require at least 50,000 terms, whereas from formula (2), by setting $a = 11$, $h = 2$, $b \to \infty$, $f(x) = \frac{1}{x}$, we get

$$\frac{1}{11} - \frac{1}{13} + \frac{1}{15} - + \cdots = \frac{1}{2}\left(\frac{1}{10} - \frac{E_1}{10^3} + \frac{E_2}{10^5} - + \cdots\right)$$

and therefore[11]

$$\frac{\pi}{4} = 1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \frac{1}{9} - \frac{1}{2}\left(\frac{1}{10} - \frac{E_1}{10^3} + \frac{E_2}{10^5} - + \cdots\right),$$

which if carried to the term containing E_4 already gives the value correct within 10^{-6} units, namely

$$\begin{aligned}
\frac{\pi}{4} = \quad & 1.00000\ 0 && -0.33333\ 3 \\
& +0.20000\ 0 && -0.14285\ 7 \\
& +0.11111\ 1 && -0.05000\ 0 \\
& +0.00050\ 0 && -0.00002\ 5 \\
& +0.00000\ 3 && -0.00000\ 1 \\
= & +1.31161\ 4 && -0.52621\ 6 \\
= & \quad 0.78539\ 8.
\end{aligned}$$

Likewise, by formula (2),[11] we readily find for

$$\ln 2 = \left(1 - \frac{1}{2} + \frac{1}{3} - \frac{1}{4} + - \cdots - \frac{1}{12}\right) + \left(\frac{1}{13} - \frac{1}{14} + \frac{1}{15} - + \cdots\right)$$

the transformation

$$\ln 2 = \left(\frac{1}{7} + \frac{1}{8} + \frac{1}{9} + \frac{1}{10} + \frac{1}{11} + \frac{1}{12}\right) + \left(\frac{1}{25} - \frac{E_1}{25^3} + \frac{E_2}{25^5} - \frac{E_3}{25^7} + - \cdots\right)$$

and thus through an easy computation the value of $\ln 2$ correct to the last decimal, namely

$$\begin{aligned}
\ln 2 = & +0.14285\ 71429 && +0.04000\ 00000 \\
& +0.12500\ 00000 && -0.00006\ 40000 \\
& +0.11111\ 11111 && +0.00000\ 05120 \\
& +0.10000\ 00000 && -0.00000\ 00100 \\
& +0.09090\ 90909 && +0.00000\ 00004 \\
& +0.08333\ 33333 && \\
= & \quad 0.65321\ 06782 && +0.03993\ 65024 \\
= & \quad 0.69314\ 71806
\end{aligned}$$

[11] Series remainder (error) < the last term used.

For the calculations at hand, serviceable for our table items, we will take from the above general formulas (1) and (2) the following special series:[12]

$$\zeta_n = 1 + \frac{1}{2^n} + \frac{1}{3^n} + \cdots + \frac{1}{(a-1)^n} + \frac{1}{(n-1)a^{n-1}} + \frac{1}{2a^n} + \frac{B_1}{2!}\cdot\frac{n}{a^{n+1}} - \frac{B_2}{4!}\cdot\frac{n(n+1)(n+2)}{a^{n+3}} + \frac{B_3}{6!}\cdot\frac{n(n+1)(n+2)(n+3)(n+4)}{a^{n+5}} - + \cdots$$

and

$$\eta_n = 1 - \frac{1}{3^n} + \frac{1}{5^n} - \frac{1}{7^n} + \cdots - \frac{(-1)^{a/2}}{(a-1)^n} + (-1)^{a/2}\cdot\left\{\frac{1}{2a^n} - \frac{E_1}{2!\,2}\cdot\frac{n(n+1)}{a^{n+2}} + \frac{E_2}{4!\,2}\cdot\frac{n(n+1)(n+2)(n+3)}{a^{n+4}} - + \cdots\right\},$$

which sufficed for the calculation of the missing summations for all required values n. For the sake of convenience in computing we chose a = 25 in formula (1), which necessitated, because of the desired accuracy $5 \cdot 10^{-35}$ for the values ζ_n, in the most unfavorable case n = 3, the evaluation of the expansion to the term with the coefficient B_{14}, *i.e.* the calculation of a total of 26 + 14 = 40 terms. In formula (2), on the assumption a = 100 and for the most unfavorable case n = 2, we must use 13 terms with coefficients E, *i.e.* a total of 50 + 13 = 63 terms, if the series remainder turned out less than 1.10^{-34}. In both cases we might have gotten along with a somewhat smaller number of terms; but then the calculations would have been much less convenient and in consequence still more time-consuming. Obviously, as the exponent n increases, more and more terms with Bernoulli and Euler numbers, respectively, drop out, so that in the case of the sums ζ_n beginning with n = 25, and in the case of η_n beginning with n = 18, such terms need no longer be considered, that is to say direct computation leads to our goal.

In addition to continued effective individual checks, the enumeration of which would lead us too far afield, the table results were also subjected to the following summary final tests:

$$\begin{aligned}
(\zeta_2 - 1) + (\zeta_4 - 1) + (\zeta_6 - 1) + \cdots &= 3/4 \\
(\zeta_3 - 1) + (\zeta_5 - 1) + (\zeta_7 - 1) + \cdots &= 1/4 \\
(1 - \eta_1) + (1 - \eta_3) + (1 - \eta_5) + \cdots &= 1/4 \\
(1 - \eta_2) + (1 - \eta_4) + (1 - \eta_6) + \cdots &= \frac{1}{2}\ln 2 - \frac{1}{4}.
\end{aligned}$$

Since the deviations from the test value which occur here amount to only a few units in the 34th place, we can be assured of the validity of our 32-place table values to a half-unit of the last place. Thus the fundamental values ζ_n and η_n were finally determined.

From them the tabulated sums on pp. 90–94 were derived by a comparatively simple computation with the aid of the following relations (n = an integer):

$$\begin{aligned}
\frac{1}{2^n} + \frac{1}{3^n} + \frac{1}{4^n} + \cdots &= \zeta_n - 1 \\
\frac{1}{2^n} + \frac{1}{4^n} + \frac{1}{6^n} + \cdots &= \frac{1}{2^n}\zeta_n
\end{aligned}$$

[12] Series remainder (error) < the last term used.

$$\frac{1}{4^n}+\frac{1}{6^n}+\frac{1}{8^n}+\cdots = \frac{1}{2^n}(\zeta_n - 1)$$
$$\frac{1}{3^n}+\frac{1}{5^n}+\frac{1}{7^n}+\cdots = \left(1-\frac{1}{2^n}\right)\zeta_n - 1$$
$$\frac{1}{2^n}-\frac{1}{3^n}+\frac{1}{4^n}-+\cdots = \left(\frac{1}{2^{n-1}}-1\right)\zeta_n + 1$$
$$\frac{1}{3^n}-\frac{1}{4^n}+\frac{1}{5^n}-+\cdots = \left(\frac{1}{2^n}-1\right)-\left(\frac{1}{2^{n-1}}-1\right)\zeta_n$$
$$\frac{1}{3^n}-\frac{1}{5^n}+\frac{1}{7^n}-+\cdots = 1-\eta_n .$$

They were added up within each of the seven groups to 34 places in checking; the sums thus obtained differed from the test values

$$1,\ \ln 2,\ \ln 2-\frac{1}{2},\ 1-\ln 2,\ \ln 2,\ 1-\ln 2,\ \frac{1}{2}\ln 2$$

only by a few units at the 34th decimal, whence the 32nd place seems to be guaranteed to a half unit.

Incidentally a comparison of our values with the 32-place sums published by Glaisher (loc. cit.), a part of these tables of sums, disclosed discrepancies in some instances of several units in the 32nd decimal; the 32-place values ζ_1 to ζ_{70} of Stieltjes (Acta Mathematica, vol. 10, 1887, p. 299) are accurate also only within two units of the last place.

It should be further noted that the missing table items beyond n = 100, 100, 50, 50, 100, 53, 53, agree with the respective reciprocal powers of 2, 2, 4, 3, 2, 3, 3 (cf. Table 2b); these values were therefore not repeated, which contributed to a clear-cut arrangement with a resulting economy of space.

TABLE 11 (pp. 95–97)

Table 11 gives the series for the calculation of 24-place values of trigonometric functions and of their logarithms for any fractional part x of a half quadrant. The derivation of these familiar series will be sketched briefly, without a rigorous demonstration of the admissibility of the method of proof employed:

The logarithmic series result immediately from the infinite products

$$\sin\frac{\pi}{2}\alpha = \frac{\pi}{2}\alpha\left(1-\frac{\alpha^2}{2^2}\right)\left(1-\frac{\alpha^2}{4^2}\right)\left(1-\frac{\alpha^2}{6^2}\right)\cdots .$$
$$\cos\frac{\pi}{2}\alpha = \left(1-\frac{\alpha^2}{1^2}\right)\left(1-\frac{\alpha^2}{3^2}\right)\left(1-\frac{\alpha^2}{5^2}\right)\cdots ,$$

if we take logarithms, apply the series for $\ln(1-x)$ to $\ln\left(1-\frac{\alpha^2}{3^2}\right)$ and the following terms, arrange the terms in order, multiply by M and replace α by $\frac{x}{2}$. We then obtain (on the general assumption[13] $0 < x < 2$) as the general term in the series for $\log\sin\frac{\pi}{4}x$:

$$-\frac{M}{n\cdot 2^{2n}}\left(\frac{1}{4^{2n}}+\frac{1}{6^{2n}}+\frac{1}{8^{2n}}+\cdots\right)x^{2n},$$

[13] Always sufficient for the practical evaluation of the series.

for $\cos \frac{\pi}{4} x$:

$$-\frac{M}{n \cdot 2^{2n}}\left(\frac{1}{3^{2n}}+\frac{1}{5^{2n}}+\frac{1}{7^{2n}}+\cdots\right)x^{2n}$$

and, after subtraction of the two series, the general term in $\log \operatorname{tg} \frac{\pi}{4} x$:

$$+\frac{M}{n \cdot 2^{2n}}\left(\frac{1}{3^{2n}}-\frac{1}{4^{2n}}+\frac{1}{5^{2n}}-+\cdots\right)x^{2n},$$

($n = 1, 2, 3, \ldots$). The coefficients were calculated to 26 places by means of the reciprocal power sums of Table 10, and their sums compared with the series values (for $x = 1$) $-\frac{1}{2}\log 2$, $-\frac{1}{2}\log 2$, 0 (cf. Table 14); here the final errors amounted to only a few units of the 26th decimal.

In the case of the familiar series for $\sin \frac{\pi}{4} x$ and $\cos \frac{\pi}{4} x$ the coefficients of both series were derived simultaneously from each other by repeated multiplication with $\frac{\pi}{4}$, and these, as required, divided by the respective numbers 1, 2, 3, ... The case $x = 1$ of the series with the common sum $\frac{1}{2}\sqrt{2}$ served as a check; here the 26th decimal differed from the test value by very little. If we take all the coefficients positive, then we have the series for the hyperbolic sine (sh) and cosine (ch), respectively; from the sums of their coefficients, the values of the constants $e^{\frac{\pi}{4}}$ and $e^{-\frac{\pi}{4}}$ follow. A comparison with the values given on p. 60 showed agreement here also to 62 decimals.

If the above series for $-\log \cos \frac{\pi}{4} x$, $\log \sin \frac{\pi}{4} x$, $\log \operatorname{tg} \frac{\pi}{4} x$ are differentiated with respect to x and multiplied by $\frac{4}{\pi M}$, and besides, x replaced by $\frac{x}{2}$ in the third series, then we get the tg-, ctg- and cosec-series, and here we have (with the common assumption[13] $0 < x < 2$) in the expansion for

$\operatorname{tg} \frac{\pi}{4} x$ the general term: $+\frac{1}{\pi 2^{2n-3}}\left(\frac{1}{3^{2n}}+\frac{1}{5^{2n}}+\frac{1}{7^{2n}}+\cdots\right)x^{2n-1}$,

$\operatorname{ctg} \frac{\pi}{4} x$ the general term: $-\frac{1}{\pi 2^{2n-3}}\left(\frac{1}{4^{2n}}+\frac{1}{6^{2n}}+\frac{1}{8^{2n}}+\cdots\right)x^{2n-1}$,

$\operatorname{cosec} \frac{\pi}{4} x$ the general term: $+\frac{1}{\pi 2^{4n-3}}\left(\frac{1}{3^{2n}}-\frac{1}{4^{2n}}+\frac{1}{5^{2n}}-+\cdots\right)x^{2n-1}$,

($n = 1, 2, 3, \ldots$). Multiplication of the values in parenthesis as given by Table 10, with the factors $\frac{1}{\pi 2^{2n-3}}$, $\frac{1}{\pi 2^{4n-3}}$, respectively, yielded the individual coefficients numerically; their sums agreed throughout, on comparison with the series sums 1, 1, $\sqrt{2}$ (where $x = 1$) within a few units in the 26th place.

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[13] Always sufficient for the practical evaluation of the series.

Finally if we form the above infinite sine product for the cases $\alpha = \frac{1-x}{2}$ and $\frac{1+x}{2}$, where it is assumed $|x| < 1$, reduce the quotients of the two results, *i.e.*,

$$\operatorname{tg}\frac{\pi}{4}(1-x) = \frac{1-x}{1+x}\cdot\frac{3+x}{3-x}\cdot\frac{5-x}{5+x}\cdots,$$

beginning with the second fraction, by means of the expansion for $\ln\frac{a+x}{a-x}$, to a series logarithmically, differentiate with respect to x, multiply by $-\frac{2}{\pi}$ and then replace x by $\frac{x}{2}$ and $\frac{1}{3}-\frac{1}{5}+\frac{1}{7}-+\ldots$ by $1-\frac{\pi}{4}$, we thus obtain the secant development for $\frac{\pi}{4}x$ with the general term

$$-\frac{1}{\pi 2^{2n-2}}\left(\frac{1}{3^{2n+1}}-\frac{1}{5^{2n+1}}+\frac{1}{7^{2n+1}}-\cdots\right)x^{2n},$$

where $|x| < 2$ by hypothesis and $n = 1, 2, 3, \ldots$. The indicated multiplications were carried out for the (known) quantities in the parenthesis (cf. Table 10) and the results by summation compared with the series value $\sqrt{2}$ (for $x = 1$) to the 26th place and found to be in agreement.

TABLE 12 (Pp. 98–126)

Table 12, which requires no further explanation, enables us to quickly obtain the prime factors of numbers under 10,000; here the primes are not specially represented. As the table was calculated entirely anew and the indicated products most carefully evaluated, their correctness is fully guaranteed. Besides, the items, so far as possible, were compared with those in other tables, e.g. the Cribrum arithmeticum of Chernac, without the disclosure of any errors not already known.

TABLE 13 (Pp. 127–152)

These tables enable us to determine quickly multiplace natural logarithms (ln) as well as, conversely, multiplace antilogarithms from their natural logarithms. To that end, besides the 48-place natural logarithms (ln) of all integers to 146 and thereafter of all primes to 9973, material taken from the reprint of Wolfram's table in Vega's Thesaurus, they give also the natural logarithms of the values $1 \pm a\,10^{-n}$ for all integers a from 9 to 1 and exponents $n = 4, 5, 6$ (Pp. 151–152). These logarithms were obtained partly by combining values from Part 1, partly by using comparatively rapidly convergent series and, wherever feasible, were ensured by double and distinct computation. On p. 152 will be found also the natural logarithms of the numbers 2, 3, 5 and 7 to 272 places, values which were taken from the work of Adams. In this connection we note that Adams utilized these logarithms to calculate Euler's constant

$$C = \left(1+\frac{1}{2}+\frac{1}{3}+\cdots+\frac{1}{a-1}\right)+\lim_{b\to\infty}\left(\frac{1}{a}+\frac{1}{a+1}+\cdots+\frac{1}{b}-\ln b\right)$$

we have already seen (p. XI) that by Euler's summation formula the following semi-convergent series[14] is valid for this purpose:

[14] Series remainder (error) is less than the last term used.

$$C = \left(1 + \frac{1}{2} + \frac{1}{3} + \cdots + \frac{1}{a-1}\right) - \ln a + \frac{1}{2a} + \frac{B_1}{2a^2} - \frac{B_2}{4a^4} + \frac{B_3}{6a^6} - + \cdots .$$

For its evaluation Adams first put a = 500 and then, as a check, a = 1000; hence he needed at least the natural logarithms of 2 and 5 in both cases.

The final result for both these values was verified by means of the relation

$$\ln 2 + \ln 5 = \frac{1}{M}.$$

Use of the 48-place Table 13. How to Find a Natural Logarithm

In order to find the natural logarithm ln N corresponding to a given number N, we divide N by the number N_0 consisting of the first 4 figures of N and multiply by 10^α (α an appropriate integer, positive or negative) so that the product $f_0 = \frac{N}{N_0} 10^\alpha$ shall lie between 1 and 2. If we multiply f_0 successively by appropriate factors $f_4 = 1 - a_4 \cdot 10^{-4}$, $f_5 = 1 - a_5 \cdot 10^{-5}$, $f_6 = 1 - a_6 \cdot 10^{-6}$, wherein the one-digit numbers a_4, a_5, a_6, in turn, agree with the first non-zero initial digit of the individual products f_0, $f_0 f_4$, $f_0 f_4 f_5$ (steadily decreasing to 1), then the natural logarithm of the final product $f_0 f_4 f_5 f_6 = 1 + k$ with the excess $k (< 10^{-6})$ can easily be determined by means of the series $\ln(1 + k) = k - \frac{k^2}{2} + \frac{k^3}{3} - \frac{k^4}{4} + \ldots$ by using (at most) seven terms. Adding to $\ln(1 + k)$ the table logarithms $-\ln f_4$, $-\ln f_5$, $-\ln f_6$ then gives $\ln f_0$ and by further adding thereto $\ln N_0$, found by composition from the logarithms of the prime factors of N_0 (see Table of Factors), and after subtracting the α-fold logarithm of 10, *i.e.* $\frac{1}{M}$ (see Table of Multiples pp. 10–11), we find the required logarithm ln N to 48 places.

Example, Find ln N, given N.

$N = 0.\ 45593\ 81277\ 65996\ 23676\ 59212\ 94728\ 02941\ 94166\ 04365\ 238 \left(= e^{-\frac{\pi}{4}}\right)$:

$\alpha = 4$, $N_0 = 4559 = 47 \cdot 97$

$f_0 := N : (N_0\, 10^{-4})$	1. 00008 36318 62242 23901 27687 97385 45606 36468 61954 898; $f_5 = 1 - 8 \cdot 10^{-5}$
	−0. 00008 00066 90548 97937 91210 21503 79083 64850 91748 956
$f_0 f_5 =$	1. 00000 36251 71693 25963 36477 75881 66522 71617 70205 942; $f_6 = 1 - 3 \cdot 10^{-6}$
	−0. 00000 30000 10875 51507 97789 00943 32764 49956 81485 311
$f_0 f_5 f_6 =$	1. 00000 06251 60817 74455 38688 74938 33758 21660 88720 631 $= 1 + k$
$k =$	0. 00000 06251 60817 74455 38688 74938 33758 21660 88720 631
$k^3 : 3 =$	0. 00000 00000 00000 00008 14430 43930 15291 52526 69164 020_5
$k^5 : 5 =$	0. 00000 00000 00000 00000 00000 00000 01909 80377 99890 382_1
$k^7 : 7 =$	0. 00000 00000 00000 00000 00000 00000 00000 00000 00005 331_4
$s_1 =$	0. 00000 06251 60817 74463 53119 18868 50959 54565 57780 365_0
$k^2 : 2 =$	0. 00000 00000 00195 41302 40215 19649 74354 75537 75808 192_5
$k^4 : 4 =$	0. 00000 00000 00000 00000 00000 38186 24995 72350 15664 078_0
$k^6 : 6 =$	0. 00000 00000 00000 00000 00000 00000 00000 00099 49454 106_9
$s_2 =$	0. 00000 00000 00195 41302 40215 57835 99350 47987 40926 377_4
$\ln(1 + k) =$	0. 00000 06251 60622 33161 12903 61032 51609 06578 16853 988 $= s_1 - s_2$
$-\ln f_6 =$	0. 00000 30000 04500 00900 00202 50048 60012 15003 12429 392
$-\ln f_5 =$	0. 00008 00032 00170 67690 73220 70360 32947 44920 18916 613
$\ln N_0 =$	8. 42485 85802 13441 40893 76722 91476 13542 27049 65404 679 $= \ln 47 + \ln 97$
sum $=$	8. 42494 22085 78734 42645 63049 72917 58110 93551 13604 672
$-\ln 10^4 =$	−9. 21034 03719 76182 73607 19658 18737 45683 04044 05954 515 $= -\frac{4}{M}$
$\ln N =$	−0. 78539 81633 97448 30961 56608 45819 87572 10492 92349 843 $\left(= -\frac{\pi}{4}\right)$

How to find the Antilogarithm Corresponding to a Natural Logarithm

In order to find the antilogarithm N corresponding to a given (at most) 48-place natural logarithm $L = \ln N$, we bring L between the limits $3/M = \ln 1{,}000 = 6.90775\ldots$ and $4/M = \ln 10{,}000 = 9.21034\ldots$ by adding an appropriate, say the α-fold (α a positive or negative integer), multiple of $\frac{1}{M} = \ln 10$, so that the antilogarithm of the new logarithm $L_0 = L + \frac{\alpha}{M} = \ln (10^\alpha N)$, thus obtained, has a four-place integer part N_0. As the first four digits of this antilogarithm L_0 can readily be determined, e.g. by ordinary five-place interpolation in Table 13, N_0 may be assumed known. If we now construct L_0 additively from the natural logarithm of N_0, which is determinable from the factors of N_0 (see Table 12), and from appropriately chosen table logarithms $\ln f_n = \ln (1 + a_n \cdot 10^{-n})$, where a_n is positive, by deducting $\ln N_0$ and successively each of the quantities $\ln f_4$, $\ln f_5$, $\ln f_6$ from L_0, until the (positive) remainder $l\,(< 10^{-6})$ is as close to zero as possible, then we have the decomposition

$$L_0 = \ln (10^\alpha N) = (\ln N_0 + \ln f_4 + \ln f_5 + \ln f_6) + l$$

and therefore, passing to the antilogarithm

$$N\,10^\alpha = e^l f_6 f_5 f_4 N_0 .$$

Hence if we multiply the value of e^l, computed by taking at most seven terms of the series $e^l = 1 + \frac{l}{1!} + \frac{l^2}{2!} + \frac{l^3}{3!} + \ldots$, successively by the factors f_6, f_5, f_4 and N_0, then we obtain after division by 10^α (shifting the decimal point) the desired antilogarithm N to 48 significant figures.

Example. Given $\ln N = L$; find N.

$L =$	$-0.\ 78539\ 81633\ 97448\ 30961\ 56608\ 45819\ 87572\ 10492\ 92349\ 844$	$\left(= -\frac{\pi}{4}\right)$
$\ln 10^4 =$	$9.\ 21034\ 03719\ 76182\ 73607\ 19658\ 18737\ 45683\ 04044\ 05954\ 515$	$= \frac{4}{M}$; $\alpha = 4$
$L_0 =$	$8.\ 42494\ 22085\ 78734\ 42645\ 63049\ 72917\ 58110\ 93551\ 13604\ 671$	; $N_0 = 4559 = 47 \cdot 97$
$-\ln N_0 =$	$-8.\ 42485\ 85802\ 13441\ 40893\ 76722\ 91476\ 13542\ 27049\ 65404\ 679$	
	$0.\ 00008\ 36283\ 65293\ 01751\ 86326\ 81441\ 44568\ 66501\ 48199\ 992$	; $f_5 = 1 + 8 \cdot 10^{-5}$
$-\ln f_5 =$	$-0.\ 00007\ 99968\ 00170\ 65642\ 73219\ 82978\ 99572\ 17282\ 83435\ 796$	
	$0.\ 00000\ 36315\ 65122\ 36109\ 13106\ 98462\ 44996\ 49218\ 64764\ 196$	; $f_6 = 1 + 3 \cdot 10^{-6}$
$-\ln f_6 =$	$-0.\ 00000\ 29999\ 95500\ 00899\ 99797\ 50048\ 59987\ 85003\ 12427\ 751$	
$l =$	$0.\ 00000\ 06315\ 69622\ 35209\ 13309\ 48413\ 85008\ 64215\ 52336\ 445$	
$l^2 : 2! =$	$0.\ 00000\ 00000\ 00199\ 44009\ 39389\ 81630\ 85855\ 07894\ 63158\ 671_5$	
$l^3 : 3! =$	$0.\ 00000\ 00000\ 00000\ 00004\ 19867\ 68270\ 30274\ 92619\ 10395\ 392_6$	
$l^4 : 4! =$	$0.\ 00000\ 00000\ 00000\ 00000\ 00000\ 06629\ 39184\ 50649\ 69574\ 854_8$	
$l^5 : 5! =$	$0.\ 00000\ 00000\ 00000\ 00000\ 00000\ 00083\ 73845\ 00802\ 343_4$	
$l^6 : 6! =$	$0.\ 00000\ 00000\ 00000\ 00000\ 00000\ 00000\ 00000\ 00000\ 88144\ 435_5$	
$l^7 \cdot 7! =$	$0.\ 00000\ 00000\ 00000\ 00000\ 00000\ 00000\ 00000\ 00000\ 00000\ 008_0$	
$e^l =$	$1.\ 00000\ 06315\ 69821\ 79222\ 72567\ 04944\ 40406\ 89224\ 84412\ 151$	; times f_6
	$0.\ 00000\ 30000\ 01894\ 70946\ 53766\ 81770\ 11483\ 32122\ 06767\ 453$	
$e^l f_6 =$	$1.\ 00000\ 36315\ 71716\ 50169\ 26333\ 86714\ 51890\ 21346\ 91179\ 604$	; times f_5
	$0.\ 00008\ 00002\ 90525\ 73732\ 01354\ 10670\ 93716\ 15121\ 70775\ 294$	
$e^l f_6 f_5 =$	$1.\ 00008\ 36318\ 62242\ 23901\ 27687\ 97385\ 45606\ 36468\ 61954\ 898$	; times $\frac{N_0}{10^4}$
$N =$	$0.\ 45593\ 81277\ 65996\ 23676\ 59212\ 94728\ 02941\ 94166\ 04365\ 238$	$\left(= e^{-\frac{\pi}{4}}\right)$

TABLE 14 (Pp. 153–162)

Table 14 enables us to calculate ordinary (Briggs) logarithms (log). Its first part, Table 14a (pp. 153–155), contains a 28-place extract from our 52-place table (see p. IV), that is to say the ordinary logarithms of the numbers $1 \pm a.\ 10^{-n}$ for one-digit a from 9 to 1 and integer n from 1 to 14; the second part, Table 14b (pp. 156–162), contains the 61-place ordinary logarithms of the numbers 1 to 100 and, beyond that, of the primes to 1097, as given by Callet (Tables portatives de logarithmes, Paris 1795, an III), together with several newly-computed special small tables with the ordinary logarithms of the values $1 \pm a \cdot 10^{-n}$ for one-digit a from 9 to 1 and $n = 3, 4, 5, 6$.

The calculation of these values was accomplished with the aid of the series

$$\log (1 \pm a \cdot 10^{-n}) = \pm \frac{Ma}{10^n} - \frac{Ma^2}{2 \cdot 10^{2n}} \pm \frac{Ma^3}{3 \cdot 10^{3n}} - \pm \cdots,$$

the calculation of the terms $\frac{Ma}{10^3}, \frac{Ma^2}{2 \cdot 10^6}, \frac{Ma^3}{3 \cdot 10^9}, \ldots, \ldots$, occurring in the case $n = 3$, for each a from 1 to 9 being wholly sufficient, since this enables us to calculate the remaining cases $n = 4, 5$ and 6 by merely moving the decimal point in the individual terms. As a check we employed the summation equation (derived from the previous formula):

$$\sum_{a=1}^{9} \log (1 \pm a \cdot 10^{-n}) = \pm \frac{M}{10^n} \sum a - \frac{M}{2 \cdot 10^{2n}} \sum a^2 \pm - \cdots.$$

wherein the individual checking sums on the right were determined by a 64-place computation of the values $\frac{M}{m\, 10^{3m}} \sum_{1}^{9} a^m$ for $m = 1, 2, \ldots, 30$ and an additive combination of these in various decimal positions.

Use of the 28-place Tables 14a. How to Find Ordinary Logarithms

Through division by a one-digit number f_0 (in appropriate decimal position) reduce the antilogarithm N to a number N_0 between 1 and 2; multiply N_0 successively by such factors[15] $f_1 = 1 - a_1 \cdot 10^{-1}$, $f_2 = 1 - a_2 \cdot 10^{-2}$, ..., that the individual products $N_0 f_1$, $N_0 f_1 f_2$, ..., steadily decrease to 1; determine the ordinary logarithm of the final product $1 + k$ by multiplying with M the small excess k ($< 10^{-m}$ in the case of 2 m-place computation) with the help of the Table of Multiples (pp. 8, 9), which suffices because of the smallness of k. Then the sum: $\log (1 + k) - \log f_1 - \log f_2 - \ldots - \log f_m + \log f_0$ is the desired logarithm of N.

Example. Given the number N. Find log N.

 Vielfache von Multiples of

[15] The quantities a coincide generally with the respective first non-zero decimal digit of the partial products $N_0 f$, $N_0 f_1 f_3$, ...

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How to Find the Antilogarithm Corresponding to an Ordinary Logarithm

The given 28-place ordinary logarithm L between 0 and 1 (dropping a possible characteristic) is brought step-by-step ever closer to zero through subtraction of the table logarithms $\log a_0$, $\log f_1 = \log\ (1 + a_1 \cdot 10^{-1})$, $\log f_2 = \log (1 + a_2 \cdot 10^{-2})$, ... (positive a); find the antilogarithm of the (positive) remainder l by forming $1 + \frac{l}{M}$, using the Table of Multiples (pp. 10–11), which suffices because 2 is very small; multiply the result successively by the numbers f_{14}, f_{13}, ..., f_1, and a_0. Then the product—except for the position of the decimal point—is the required antilogarithm of the given logarithm L.

Example. Given $\log N = L$. Find N.

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Use of the 61-Place Tables 14b. How to Find Ordinary Logarithms

In order to find an ordinary logarithm log N corresponding to a given 61-place number N, divide it by the number N_0 formed from its first three digits, in such a decimal position that the quotient $\frac{N}{N_0} = f_0$ shall lie between 1 and 2. If we now multiply f_0 successively by appropriate factors $f_3 = 1 - a_3 \cdot 10^{-3}$, $f_4 = 1 - a_4 \cdot 10^{-4}$, $f_5 = 1 - a_5 \cdot 10^{-5}$, $f_6 = 1 - a_6 \cdot 10^{-6}$, wherein the one-digit numbers a_3, a_4, ... for the most part coincide with the various non-zero initial digits (after the decimal point) of the individual products f_0, $f_0 f_3$, $f_0 f_3 f_4$ ..., which steadily decrease to 1, then the ordinary logarithm of the end product $f_0 f_3 f_4 f_5 f_6 = 1 + k$ ($k < 10^{-6}$) can be determined readily with the aid of the series

$$\log (1 + k) = M \left(k - \frac{k^2}{2} + \frac{k^3}{3} - + \cdots \right)$$

by using (at most) ten terms thereof and the Table of Multiples of the modulus M (pp. 8–9). The addition of the table logarithms $-\log f_3$, $-\log f_4$, $-\log f_5$, $-\log f_6$, to $\log (1 + k)$, then gives $\log f_0$ and thereby through further addition of the logarithm $\log N_0$, found by combining the logarithms of the prime factors of N_0 (using Table 12), the required logarithm log N to 61 places.

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Example. Find log N corresponding to N.

Multiplication by Modulus M, as in Example on p. XX gives:

How to Find the Antilogarithm to an Ordinary Logarithm

In order to find the antilog N corresponding to a given 61-place ordinary logarithm $L = \log N$, deduct from L (without considering the characteristic) the logarithm of the largest possible number N_0 of at least four figures so that the difference still remains positive. It is advisable to take N_0 from the initial figures of the required antilogarithm; the logarithm of N is composed from the logarithms of its factors (see Table of Factors).

If we now subtract from the remaining difference $(L - \log N_0)$ successively the largest possible table logarithms $\log f_n = \log (1 + a_n \cdot 10^{-n})$ with positive a_n, until the remainder l is less than 10^{-6}, then we have the decomposition $L - \log N_0 = (\log f_3 + \log f_4 + \log f_5 + \log f_6) + l$ and hence on passage to the antilogarithm (neglecting the decimal point):

$$N = 10^l f_6 f_5 f_4 f_3 N_0 .$$

Therefore if we multiply the value of 10^l computed from the series $10^l = 1 + \frac{1}{M} + \frac{1}{2!}\left(\frac{1}{M}\right)^2 + \frac{1}{3!}\left(\frac{1}{M}\right)^3 + \ldots$, by using at most nine terms and the Table of Multiples for the reciprocal modulus $\left(\frac{1}{M}\right)$ (see pp.10–11) successively by the factors f_6, f_5, f_4, f_3 and N_0, then we obtain, after inserting the decimal point properly, the required antilogarithm N to 61 significant figures.

Example. Find N from $\log N = L$.

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Multiplication by $\frac{1}{M}$, as in Example on p. XXI, gives:

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The foregoing examples to Tables 13 and 14 show that, by comparatively simple means, we can determine a logarithm to any desired degree of accuracy so long as we do not require more than 61 decimal places for any logarithm whether natural or ordinary. (The natural logarithms, for which hereinabove, it is true, only 48 places were taken into consideration, can be derived likewise to 61 places by way of Briggs logarithms, with the 61-place table of multiples of $\frac{1}{M}$ (pp. 10–11). In the case of still greater accuracy requirements (than 61 places), we can achieve our goal by a generous use of logarithmic series, which, however, need to be in a practicable convergent form if the calculation of a logarithm with more than 61 places is not to proceed too tediously. To that end, however, we need a stock of fundamental logarithms, consisting of the logarithms of primes (beginning with 2, 3, 5, 7, ...), because they are the backbone of rapidly convergent logarithmic series. As we learned after the compilation of these tables, Dr. Grimpen has calculated such a stock of logarithms, inclusive of the prime 113, to 82 and 84 places, respectively. We pass on to the reader the results, which he was kind enough to make available.

Natural Logarithms (82-place) by Dr. A. Grimpen

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Ordinary Logarithms (84-place) by Dr. A. Grimpen

It would be worthwhile to extend the foregoing stock of logarithms (of both kinds). An indication of how this can be done, perhaps most readily, may be suggested in what

follows by a few general remarks and a detailed example. Let "[N]" denote the series

$$[N] \equiv 2\left(\frac{1}{N} + \frac{1}{3N^3} + \frac{1}{5N^5} + \frac{1}{7N^7} + \cdots\right)$$

when $|N| > 1$, for which it is absolutely convergent, and let $x_1, x_2, x_3, \ldots$ (increasing) be consecutive natural numbers; then it is easy to prove, by means of the familiar logarithmic series

$$\ln \frac{N+1}{N-1} = [N]$$

the validity of the following series theorems:

1. $\ln \frac{x_3}{x_1} = [x_2]$

2. $\ln \frac{x_2}{x_1} = [x_1 + x_2]$

3. $\ln \frac{x_2^2}{x_1 x_3} = [2x_2^2 - 1]$

4. $\ln \frac{x_2^2 x_5}{x_1 x_4^2} = \left[\frac{x_2 x_3 x_4}{2} - x_3\right]$

5. $\ln \frac{x_2^2 x_7^2}{x_1 x_4 x_5 x_8} = \left[\frac{x_2^2 x_7^2}{18} - 1\right]$

6. $\ln \frac{x_3^2 x_{16}^2}{x_1 x_6 x_{13} x_{18}} = \left[2\left(\frac{x_3 x_{16}}{30}\right)^2 - 1\right]$.

wherein the series are arranged according to their rapidity of convergence. The fourth is known as Borda's series; the fifth and sixth are due to Dr. Stein. The last two are the most rapidly convergent; they can be most readily evaluated if x_2 or x_7 (in the fifth), x_3 or x_{16} (in the sixth) is divisible by 3.

Now, if we wish to determine the 82-place natural logarithm of the prime p, then we choose the integer x_1, and accordingly the subsequent numbers $x_2, x_3, \ldots$ so that the numbers of numerator and denominator occurring under the logarithm sign ln of the formula to be employed, besides the factor p, contain only prime factors whose 82-place logarithms are already known. Thus do we succeed in expressing the required ln p in terms of known logarithms and of the series on the right. The quest for an appropriate number series $x_1, x_2, \ldots$ is made substantially easier by the use of the prime factor table. So as to exclude every error in computation, it is suggested that the natural logarithm ln p be calculated by means of one formula, then the Briggs logarithm log p by means of the other formula, and as final check the identity $\log p = M \cdot \ln p$ or $\ln p = \frac{1}{M} \log p$ be verified. If the two results coincide, then ln p as well as log p is correct.

As an illustration we calculate the logarithms (ln and log) of the prime following 113, namely 127.

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Calculation of log 127

Calculation of ln 127

Page XXVIII

Calculation of log 127 by Formula 4

Choose for example:

$$x_1 = 6600 = 2^3 \cdot 3 \cdot 5^2 \cdot 11 \text{ , hence}$$
$$x_2 = 6601 = 7 \cdot 23 \cdot 41$$
$$x_4 = 6603 = 3 \cdot 31 \cdot 71$$
$$x_5 = 6604 = 2^2 \cdot 13 \cdot 127 \text{ ,}$$

then formula 4 furnishes immediately the computing expression:

$$\log 127 = M\,[N] + (\log 2 + 3 \log 3 + 2 \log 5 + \log 11 + 2 \log 31 + 2 \log 71)$$
$$- (2 \log 7 + \log 13 + 2 \log 23 + 2 \log 41) \text{ ,}$$

where N = 1438 7870 9701. The actual computation will be found on the preceding page.

For the further computation of ln 127, say by formula 5, set for example:

$$x_1 = 3549 = 3 \cdot 7 \cdot 13^2$$
$$x_2 = 3550 = 2 \cdot 5^2 \cdot 71$$
$$x_4 = 3552 = 2^5 \cdot 3 \cdot 37$$
$$x_5 = 3553 = 11 \cdot 17 \cdot 19$$
$$x_7 = 3555 = 3^2 \cdot 5 \cdot 79$$
$$x_8 = 3556 = 2^2 \cdot 7 \cdot 127 \text{ ,}$$

then we have from 5 the computing formula:

$$\ln 127 = + (2 \ln 3 + 6 \ln 5 + 2 \cdot \ln 71 + 2 \ln 79)$$
$$- \{[N] + 5 \ln 2 + 2 \ln 7 + \ln 11 + 2 \ln 13 + \ln 17 + \ln 19 + \ln 37\} \text{ ,}$$

where N = 8 8483 7278 1249. The details of this computation will be found on the preceding page. (If we use formula 6 we may take for instance $x_1 = 7488$).

To check both logarithms we calculate the product of log 127 and $\frac{1}{M}$; the end figures of ln 127 thus determined differ by only 4 units from the value previously found.

Thus the two logarithms of 127 are ensured to at least 81 places.

Pages 163–195 contain tables for the calculation of 20-place logarithms of the trigonometric functions, computed and compiled by Professor G. Witt. Explanations and examples to these tables will be found on pages 163–166.

Peters
Stein

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Tables for the Calculation of Twenty-Two-Place Logarithms of Trigonometric Functions

Calculated and compiled by Professor G. Witt

These tables, companions to the well-known tables by Peters,[16] contain the 22-place values of log sin, log cos and log tg for the angles 0^0—45^0 to every ten minutes (Table I) and for 0′—10′ to every second (Table II). They enable us to determine the logarithms of trigonometric functions for any argument $\alpha \pm \Delta\alpha$ by means of the formulas

$$\log \sin (\alpha \pm \Delta\alpha) = \log \sin \alpha + \log \cos \Delta\alpha + \log \left(1 \pm \frac{\operatorname{tg} \Delta\alpha}{\operatorname{tg} \alpha}\right),$$

$$\log \cos (\alpha \pm \Delta\alpha) = \log \cos \alpha + \log \cos \Delta\alpha + \log (1 \mp \operatorname{tg} \alpha \cdot \operatorname{tg} \Delta\alpha),$$

$$\log \operatorname{tg} (\alpha \pm \Delta\alpha) = \log \operatorname{tg} \alpha + \log \left(1 \pm \frac{\operatorname{tg} \Delta\alpha}{\operatorname{tg} \alpha}\right) - \log (1 \mp \operatorname{tg} \alpha \cdot \operatorname{tg} \Delta\alpha)$$

where α is an argument of Table I and $\Delta\alpha$ is less than 10′. Of the logarithms required to be calculated, namely log cos $\Delta\alpha$ and log tg $\Delta\alpha$, the first is obtained by interpolation from Table II and the second by the addition of log $\Delta\alpha''$ to the auxiliary values (likewise to be interpolated) tabulated in Table II:

$$T = \log \operatorname{tg} \Delta\alpha - \log \Delta\alpha''.$$

The passage from logarithm to antilogarithm and conversely is done in the usual manner. Besides, the illustrative examples give further information concerning the details.

As to the calculation of the succeeding tables we mention only the following. The source of Table I is the formula

$$\log \sin n \cdot 10' = \log n + \log (1080 - n) + \log (1080 + n) + \log \frac{\pi}{8} - 3 \log 540 - \sum_{1}^{\infty} i\, s_{2i}\, n^{2i}$$

with the coefficients

$$s_{2i} = \frac{M}{i\, 540^{2i}} \left(\frac{1}{4^{2i}} + \frac{1}{6^{2i}} + \frac{1}{8^{2i}} + \cdots\right).$$

---

[16] *Twenty-one-Place Values of the Functions sine and cosine*, computed and compiled by Prof. J. Peters. From the Appendix to the Papers of the Royal Prussian Academy of Sciences of 1911.

After verifying and wherever necessary redetermining the values s_{2i}, which could not be taken from Callet's Tables safely, the last part of the formula was separated into

$$A_n = \log \frac{\pi}{8} - 3 \log 540 - \sum_{1}^{5} s_{2i} n^{2i} \text{ and}$$

$$B_n = \sum_{6}^{\infty} s_{2i} n^{2i}$$

of which the first as a function of the 10th degree in n was obtained by successively adding all ten difference series (for every n from 1 to 270), and the second by termwise numerical (to n = 135), or logarithmic calculation (n = 135 to 270). As a check, we employed in the case of A_n the direct calculation of several principal values (for n = 18, 36, 54, ...), which disclosed an agreement to 25 decimals inclusive; and in the case of B_n the formation of differences. The first part of the formula was put together from the logarithms of the numbers 1 to 27 and 810 to 1350, which we were enabled to determine with the tables of Callet and of Wolfram, respectively, after we had checked all the logarithms to 1350 from the 9th to the 25th decimal and, besides, from log 300 on, by groups of eleven consecutive logarithms, according to:

$$\left.\begin{array}{l} \log (x-5)(x+5) - 10 \log (x-4)(x+4) \\ \quad + 45 \log (x-3)(x+3) - 120 \log (x-2)(x+2) \\ \quad + 210 \log (x-1)(x+1) - 252 \log x \end{array}\right\} = -\frac{9!\,M}{x^{10}} - \frac{5}{12} \cdot \frac{11!\,M}{x^{12}} - \cdots$$

and the rest (to log 300) by an indirect method (see below).

From log sin, thus obtained, the values log cos and log tg were found readily by using the relations:

$$\cos x = \frac{1}{2} \frac{\sin 2x}{\sin x} = \frac{1}{2} \frac{\cos (90^\circ - 2x)}{\sin x} \text{ und } \operatorname{tg} x = \frac{\sin x}{\cos x}$$

We checked log cos by rigorous difference formation, and all the logarithm values (after curtailment to 22 decimals) by summing all the values of each of the functions log sin, log cos, log tg. These sums had to satisfy the condition

$$\sum \log \sin - \sum \log \cos = \sum \log \operatorname{tg}$$

A second verification of the sums is furnished by the following. Let n denote a positive even number and α any angle; then we have:

$$\left| \cos \alpha \cos \left(\alpha + \frac{\pi}{n}\right) \cos \left(\alpha + \frac{2\pi}{n}\right) \cdots \cos \left(\alpha + \frac{(n-1)\pi}{n}\right) \right| = \left| \frac{\sin n\alpha}{2^{n-1}} \right|.$$

If we now set $\alpha = 0$, then

$$\cos \frac{\pi}{n} \cos \frac{2\pi}{n} \cdots \cos \frac{(n-2)\pi}{2n} = \frac{\sqrt{n}}{2^{\frac{n}{2}-1}} \text{ and for}$$

$$n = 540: \quad \cos 10' \cos 20' \cdots \cos 5390' = \frac{\sqrt{540}}{2^{269}}.$$

Taking logarithms, we obtain:

$$\sum \log \sin + \sum \log \cos = \frac{1}{2} \log 540 - 269 \log 2.$$

This last, thorough verification, disclosed a complete agreement, within a few units at the 22nd place, so that full guaranty for the correctness of the tables can be given.

For the calculation of Table II the expressions

$$S_n = \log \sin n - \log n'' = \log \text{arc } 1'' - \sum_1^\infty i\, S_{2i}\, n^{2i},$$

$$\log \cos n = -\sum_1^\infty i\, C_{2i}\, n^{2i},$$

$$T_n = \log \operatorname{tg} n - \log n'' = \log \text{arc } 1'' + \sum_1^\infty i\, T_{2i}\, n^{2i},$$

which contain the coefficients

$$S_{2i} = \frac{M}{i\,324000^{2i}}\left(\frac{1}{2^{2i}} + \frac{1}{4^{2i}} + \frac{1}{6^{2i}} + \cdots\right),$$

$$C_{2i} = \frac{M}{i\,324000^{2i}}\left(1 + \frac{1}{3^{2i}} + \frac{1}{5^{2i}} + \cdots\right),$$

$$T_{2i} = \frac{M}{i\,324000^{2i}}\left(1 - \frac{1}{2^{2i}} + \frac{1}{3^{2i}} - + \cdots\right)$$

were determined for the principal cases n = 10, 20, 30, ..., 640, by setting aside, from the sums on the right, every first pair of terms as integral functions of the fourth degree, and calculation as well as checks of both parts were done as above. The passage from a ten-second to a one-second interval was effected by interpolation from both ends of the interval. The function values at the center of the interval, which thereby occurred twice, always agreed within a unit at the 25th place. The addition of log n'' then gave the table values log sin, log tg. As a check, we employed the formula sin 2n = 2 sin n cos n for the first five minutes of arc (which served also for the logarithms from 1 to 300), and, for the remaining five minutes, we formed the tenth difference from eleven neighboring log sin by a formula similar to the one above. After rounding-off to 22 decimals we carried out the check here also by constructing the sums by sides in the manner given above.

Examples:

1. *Calculation of log cos 12° 4′ 38″ in two ways*

If we begin with $\alpha_1 = 12^0\ 0'$ the first time, with $\alpha_2 = 12^0\ 10'$ the second time, *i.e.* if we choose $\Delta\alpha_1 = 4'\,38''$ in the first case, $\Delta\alpha_2 = 5'\,22''$ in the second, then, as a first step, we find in Table I and Table II, respectively:

$\log \operatorname{tg} \alpha_1 = 9.\ 32747\ 45162\ 80779\ 01970\ 36$	$\log \operatorname{tg} \alpha_2 = 9.\ 33364\ 62536\ 23209\ 92289\ 04$
$\log \operatorname{tg} \Delta\alpha_1 = 7.\ 12961\ 99257\ 09412\ 60703\ 08$	$\log \operatorname{tg} \Delta\alpha_2 = 7.\ 19343\ 10913\ 16287\ 84508\ 96$
$\log (\operatorname{tg} \alpha_1 \operatorname{tg} \Delta\alpha_1) = 6.\ 45709\ 44419\ 90191\ 62673\ 44$	$\log (\operatorname{tg} \alpha_2 \operatorname{tg} \Delta\alpha_2) = 6.\ 52707\ 73449\ 39497\ 76798\ 00.$

Determining the antilogarithms to these logarithms, we have:

$\operatorname{tg} \alpha_1 \operatorname{tg} \Delta\alpha_1 = 0.\ 00028\ 64800\ 88383\ 37963\ 64$	$\operatorname{tg} \alpha_2 \operatorname{tg} \Delta\alpha_2 = 0.\ 00033\ 65715\ 05169\ 87606\ 25.$

hence

$1 - \operatorname{tg} \alpha_1 \operatorname{tg} \Delta\alpha_1 = 0.\ 99971\ 35199\ 11616\ 62036\ 36$	$1 + \operatorname{tg} \alpha_2 \operatorname{tg} \Delta\alpha_2 = 1.\ 00033\ 65715\ 05169\ 87606\ 25.$

Now we calculate the logarithms for $(1 - \operatorname{tg} \alpha_1 \operatorname{tg} \Delta\alpha_1)$ and $(1 + \operatorname{tg} \alpha_2 \operatorname{tg} \Delta\alpha_2)$; we obtain:

$\log (1 - \operatorname{tg} \alpha_1 \operatorname{tg} \Delta\alpha_1) = 9.\ 99987\ 55654\ 53578\ 85476\ 2$

$\log (1 + \operatorname{tg} \alpha_2 \operatorname{tg} \Delta\alpha_2) = 0.\ 00014\ 61465\ 54457\ 64032\ 5$

Add to that:

$\log \cos \alpha_1 = 9.\ 99040\ 43939\ 97745\ 15987\ 92$ | $\log \cos \alpha_2 = 9.\ 99013\ 39476\ 40509\ 07845\ 45$

$\log \cos \Delta\alpha_1 = 9.\ 99999\ 96055\ 48354\ 05079\ 30$ | $\log \cos \Delta\alpha_2 = 9.\ 99999\ 94708\ 04711\ 34665\ 47$

and we thus obtain the two values, coinciding to 21 decimal places:

Page 166

2. Calculation of log sin $25^0\ 46'\ 11\frac{1}{3}''$ in two ways

If we begin with $\alpha_1 = 25^0\ 40'$ the first time, with $\alpha_2 = 25^0\ 50'$ the second time, *i.e.* if we choose $\Delta\alpha_1 = 6'\ 11\frac{1}{3}'' = \frac{1114''}{3}$ in the first case, $\Delta\alpha_2 = 3'\ 48\frac{2}{3}'' = \frac{686''}{3}$ in the second, then we first calculate log tg $\Delta\alpha$. For that purpose we take the value T ($\Delta\alpha$) by interpolating in Table II:

T ($\Delta\alpha_1$) $= 4.\ 68557\ 53360\ 05160\ 97853\ 47$ | T ($\Delta\alpha_2$) $= 4.\ 68557\ 50447\ 41027\ 93016\ 86$;

if we add thereto

$\log \frac{1114}{3} = 2.\ 56976\ 39361\ 18047\ 65836\ 21$ | $\log \frac{686}{3} = 2.\ 35920\ 28609\ 87089\ 25005\ 54$,

we obtain:

$\log \operatorname{tg} \Delta\alpha_1 = 7.\ 25533\ 92721\ 23208\ 63689\ 68$ | $\log \operatorname{tg} \Delta\alpha_2 = 7.\ 04477\ 79057\ 28117\ 18022\ 40$.

From Table I we take

$\log \operatorname{tg} \alpha_1 = 9.\ 68173\ 96417\ 53629\ 04193\ 61$ | $\log \operatorname{tg} \alpha_2 = 9.\ 68496\ 81168\ 56574\ 12545\ 68$;

then we have:

$\log (\operatorname{tg} \Delta\alpha_1 \operatorname{ctg} \alpha_1) = 7.\ 57359\ 96303\ 69579\ 59496\ 07$ | $\log (\operatorname{tg} \Delta\alpha_2 \operatorname{ctg} \alpha_2) = 7.\ 35980\ 97888\ 71543\ 05476\ 72$.

Determining the antilogarithms to these logarithms we obtain

$\operatorname{tg} \Delta\alpha_1 \operatorname{ctg} \alpha_1 = 0.\ 00374\ 62747\ 94964\ 17471\ 08$ | $\operatorname{tg} \Delta\alpha_2 \operatorname{ctg} \alpha_2 = 0.\ 00228\ 98645\ 24407\ 91790\ 01$

$1 + \operatorname{tg} \Delta\alpha_1 \operatorname{ctg} \alpha_1 = 1.\ 00374\ 62747\ 94964\ 17471\ 08$ | $1 - \operatorname{tg} \Delta\alpha_2 \operatorname{ctg} \alpha_2 = 0.\ 99771\ 01354\ 75592\ 08209\ 99$.

Now we calculate the logarithms of $(1 + \operatorname{tg} \Delta\alpha_1 \operatorname{ctg} \alpha_1)$ and $(1 - \operatorname{tg} \Delta\alpha_2 \operatorname{ctg} \alpha_2)$, we obtain:

$\log (1 + \operatorname{tg} \Delta\alpha_1 \operatorname{ctg} \alpha_1) = 0.\ 00162\ 39464\ 91974\ 56468\ 2$

$\log (1 - \operatorname{tg} \Delta\alpha_2 \operatorname{ctg} \alpha_2) = 9.\ 99900\ 43841\ 24467\ 19513\ 6$;

by interpolation from Table II:

$\log \cos \Delta\alpha_1 = 9.\ 99999\ 92962\ 27721\ 37279\ 85$ | $\log \cos \Delta\alpha_2 = 9.\ 99999\ 97331\ 23790\ 75028\ 34$;

from Table I:

$\log \sin \alpha_1 = 9.\ 63662\ 30641\ 34843\ 05136\ 78$ | $\log \sin \alpha_2 = 9.\ 63924\ 21896\ 06281\ 04342\ 86$

By addition we find the two values:

$\log \sin 25°\ 46'\ 11\frac{1}{3}'' = 9.\ 63824\ 63068\ 54538\ 98884\ 8$ | $\log \sin 25°\ 46'\ 11\frac{1}{3}'' = 9.\ 63824\ 63068\ 54538\ 98884\ 8$

which agree to 21 decimal places.

VOLUME II

First pages

Introduction

The second volume of the ten-place logarithm tables contains the logarithms of the trigonometric functions for every thousandth of a degree. The arrangement is the one customarily used, and need be but briefly described here. On every pair of facing pages are found the function values of the hundred thousandths of each tenth part of a degree, so that each of the 90 degrees of the quadrant comprises twenty pages. In the argument columns to the left (right) the whole degrees are set apart, in heavy type, above (below) the one-thousandths. The passage from one degree to the next is indicated by an asterisk (*) before .000. Thus, on p. 21 in the argument column at the left below, *.000 means that this row contains the logarithms of the trigonometric functions of $1.^{0}000$; likewise the notation *.000 in the argument column at the right above on p. 22 is to be connected not with degree 88 at the end of the column, but with 89, so that here we must read the argument as $89^{0}.000$. The three columns containing d above and below give by turns the differences of the function values log sin, log tang, log cos.

Whereas in the case of logarithm tables with fewer decimal places these differences, in general, change only insignificantly from value to value, here we shall encounter very marked differences between two successive d values, especially in log sin and log tang in the first part of the table. In the interpolation of table values for a given argument this variableness of the first differences must be taken into consideration. This is done by means of the "correction of the first difference" given in the Auxiliary Tables to the Ten-Place Logarithm Tables on pp. 4–23. This auxiliary table has two arguments : 1) as horizontal argument, the second difference, i.e., the difference between the two table differences; 2) as vertical argument, the phase, i.e., the given fractional part of the interval in the table argument for which we are to interpolate the function values of the table. Corresponding to the two above-mentioned arguments, we take from this auxiliary table the pertinent correction of the first difference and apply this correction to the value of the first difference under consideration in such a manner that the corrected value falls between the two first differences enclosing the function value. With the first difference as thus corrected the interpolation can be carried out in the usual way.

The following examples will explain this procedure.

Example 1. Determine log sin $3^0.175\ 23814$.

On p. 65 we find

$$\log \sin 3^0.175 = 8.743\ 3988\ 073 \quad \left| \begin{array}{l} 1366\ 672 \\ \uparrow\ 1366\ 241 \end{array} \right. \quad (431)$$

The number in parentheses (431) is the second difference, i.e., the difference between the two first differences under consideration. With 430 (nearest table argument) as horizontal argument and 0.24 (approximate value of the phase 0.23814) as vertical argument, we find on p. 12 of the auxiliary tables "163" as the correction to the first difference. If we add that to 1366 241 (i.e., in the direction of the arrow), we obtain 1366 404 as corrected first difference; multiplying this by the phase 0.23814, we get $1366\ 404 \times 0.23814 = 325\ 395$, the amount by which the table value of log sin is to be increased. Thus we obtain

$$\log \sin 3^0.175\ 23814 = \left.\begin{array}{r} 8.743\ 3988\ 073 \\ +\ 325\ 395 \end{array}\right\} = 8.743\ 4313\ 468.$$

Example 2. Determine log tang $86^0.837\ 76186$.

On p. 65 we find

$$\log \text{tang}\ 86^0.837 = 1.257\ 5819\ 461 \quad \left| \begin{array}{l} \downarrow\ 1376\ 057 \\ \quad 1375\ 623 \end{array} \right. \quad (434)$$

Here (434) is the second difference, i.e. the difference between the two first differences. With 430 (nearest table argument) as horizontal argument and 0.76 (approximate value of the phase 0.76186) as vertical argument we find on p. 13 of the auxiliary tables "52" as the correction of the first difference. If we annex this to 1376 057 in the sense denoted by the arrow, then we obtain $1376\ 057 - 52 = 1376\ 005$ as the corrected first difference; multiplying by the phase 0.76 186, we get $1376\ 005 \times 0.76186 = 1048\ 323$, the amount by which the table value of log tang is to be increased. Thus we obtain

$$\log \text{tang}\ 86^0.837\ 76186 = \left.\begin{array}{r} 1.257\ 5819\ 461 \\ 1048\ 323 \end{array}\right\} = 1.257\ 6867\ 784.$$

Example 3. Determine log cotg $3^0.115\ 12869$.

On p. 64 we find

$$\log \text{cotg}\ 3^0.115 = 1.2642363943 \quad \left| \begin{array}{l} 1397\ 179 \\ \uparrow\ 1396\ 731 \end{array} \right. \quad (448)$$

Here (448) is the second difference, i.e., the difference between the two first differences. With 450 (nearest table argument) as horizontal argument and 0.13 (approximate value of the phase 0.12869) as vertical argument we find on p. 12 of the auxiliary tables "196" as the correction to the first difference. If we annex this to 1396 731 in the sense denoted by the arrow, then we obtain 1396 927 as the corrected first difference; multiplying the latter by the phase we obtain $1396\ 927 \times 0.12869 = 179\ 771$, the amount by which the table value of log cotg is to be decreased. Thus we get

$$\log \text{cotg}\ 3^0.115\ 12869 = \left.\begin{array}{r} 1.264\ 2363\ 943 \\ -\ 179\ 771 \end{array}\right\} = 1.264\ 2184\ 172$$

Example 4. Determine log cos $86^0.850\ 72854$.

On pp. 64–65 we find

$$\log \cos 86^0.850 = 8.739\ 9691\ 187 \quad \Big| \begin{matrix} \downarrow\ 1377\ 543 \\ \quad\ 1377\ 104 \end{matrix} \qquad (439)$$

Here (439) is the second difference, i.e., the difference between the two first differences. With 440 (nearest table argument) as horizontal argument and 0.73 (approximate value of the phase 0.72854) as vertical argument we find on p. 13 of the auxiliary tables "59" as the correction to the first difference. If we annex this to 1377 543 in the sense indicated by the arrow, then we obtain $1377\ 543 - 59 = 1377\ 484$ as improved first difference; multiplying the latter by the phase 0.72854, yields $1377\ 484 \times 0.72854 = 1003\ 552$, the amount by which the table value of log cos is to be decreased. Hence

$$\log \cos 86^0.850\ 72854 = \left.\begin{matrix} 8.739\ 9691\ 187 \\ -\ 1003\ 552 \end{matrix}\right\} = 8.739\ 8687\ 635$$

If we desire, conversely, to determine the angle corresponding to the given logarithm of a trigonometric function, we look up first the table value next smaller in the case of log sin and log tang, next larger in the case of log cos and log cotg, and determine the difference between this table value and the given logarithm. Then calculate[15] an approximate value for the phase by dividing the difference just found by the table difference of the interpolation interval, to be found in column d, for the table value used. With the approximate phase thus obtained and the second difference, take from the auxiliary tables the correction to the first difference. If we annex to the table difference this correction and divide the first difference as thus improved into the difference between the given logarithm and the table value, then the result will be the true phase and therewith the required angle is known.

Example 5. Determine x, given $\log \sin x = 8.743\ 4313\ 468$.

On p. 65 we find

$$\log \sin 3^0.175 = 8.743\ 3988\ 073 \quad \Big| \begin{matrix} \quad\ 1366\ 672 \\ \uparrow\ 1366\ 241 \end{matrix} \qquad (431)$$

Given, $\log \sin x = 8.743\ 4313\ 468$

Diff. between the two values $= 325\ 395$.

Hence approximate phase $= 325\ 395 : 1366\ 241 = 0.24$.

With the two arguments, to wit, the second difference $= 430$ and the phase $= 0.24$, we find on p. 12 of the auxiliary tables "163" as the correction to the first difference and therewith $1366\ 241 + 163 = 1366\ 404$ as improved first difference. Then the true phase is $325\ 395 : 1366\ 404 = 0.23814$ and the required angle,

$$x = 3^0.175\ 23814.$$

Example 6. Determine x, given $\log \text{tang}\ x = 1.257\ 6867\ 784$.

On p. 65 we find

$$\log \text{tang}\ 86^0.837 = 1.257\ 5819\ 461 \quad \Big| \begin{matrix} \downarrow\ 1376\ 057 \\ \quad\ 1375\ 623 \end{matrix} \qquad (434)$$

Given, $\log \text{tang}\ x = 1.257\ 6867\ 784$

[15] By means of a slide rule.

Diff. between these values = 1048 323
Hence approximate phase = 1048 323 : 1376 057 = 0.76

With the second difference 430 and the phase 0.76 we find on p. 13 of the auxiliary tables "52" as the correction to the first difference and hence 1376 057–12 = 1376 005 as improved first difference. Then the true phase is 1048 323 : 1376 005 = 0.76186 and the required angle,

$$x = 86^0.837\ 76186.$$

Example 7. Given log cotg x = 1.264 2184 172. Find x.

We see on p. 64 that

log cotg $3^0.115$ = 1.264 2363 943 | ↑ 1397 179 / 1396 731 (448)

Given, log cos x = 1.264 2184 172
Diff. between these values = 179 771
Hence approximate phase = 179 771 : 1396 731 = 0.13

With the second difference 450 and the phase 0.13 we find on p. 12 of the auxiliary tables "196" as the correction to the first difference and hence 1396 731 + 196 = 1396 927 as improved first difference. Then the true phase is 179 771 : 1396 927 = 0.128 69 and the required angle,

$$x = 3^0.115\ 12869$$

Example 8. Given log cos x = 8.739 8687 635. Find x.

We see on pp. 64–65 that

log cos $86^0.850$ = 8.739 9691 187 | ↓ 1377 543 / 1377 104 (439)

Given, log cos x = 8.739 8687 635
Diff. between these values = 1003 552
Hence the approximate phase = 1003 552 : 1377 543 = 0.73

With the second difference 440 and the phase 0.73 we find on p. 13 of the auxiliary tables "59" as the correction to the first difference and hence 1377 543–59 = 1377 484 as improved first difference. Then the true phase is 1003 552 : 1377 484 = 0.72854 and the required angle,

$$x = 86^0.850\ 72854.$$

In order to keep the second differences below 1000, thus making it unnecessary to take into account third differences, and consequently fashioning the interpolation as conveniently as possible, only eight or nine decimal places for log sin and log tang are given at the beginning of the table (to p. 43). This causes no impairment of accuracy in obtaining the angle from its functions: here, too, the table gives the angle correct within one or two units of the eighth decimal of a degree; hence the fourth decimal of the second of arc is still fully ensured (cf. Auxiliary Tables p. 57).

The above method of interpolation would lead to inaccurate results for log sin and log tang of the first six pages. Wherefore the two difference columns there have been replaced by the (easily interpolated) values of S and T, which, added to the logarithm of the angle-number, furnish precise values of log sin and log tang.

Example 9. It is required to find log sin $0^0.239\ 58637$

We have	log 0.239 58637	= 9.379 4621 1
Add	S	= 8.241 8761 0
Hence	log sin $0^0.239\ 58637$	= 7.621 3382 1

Example 10. It is required to find log tang $0^0.185\ 23429$

We have	log 0.185 23429	= 9.267 72139
Add	T	= 8.241 87888
Hence	log tang $0^0.185\ 23429$	= 7.509 60027

Conversely, in order to determine the angle from log sin or log tang, we seek the pertinent value of S or T, subtract this value from the given logarithm and obtain thereby the logarithm of the angle-number; the antilogarithm of this logarithm is the required angle.

Example 11. Given log sin x = 7.621 33821. Find x.

We have	log sin x	= 7.621 33821
From p. 6,	S	= 8.241 87610
Difference	log x	= 9.379 46211
Hence	x	= $0^0.239\ 58637$

Example 12. Given log tang x = 7.509 60027. Find x.

We have	log tang x	= 7.509 60027
From p. 5,	T	= 8.241 87888
Difference	log x	= 9.267 72139
Hence	x	= $0^0.185\ 23429$

If in dealing with small angles ($0^0.000$ to $2^0.100$) ten-place log sin and log tang are required, then the ten-place values of S and T on pp. 26–46 of the Auxiliary Tables to the Ten-place Logarithm Tables are to be employed. Examples for the use of these values will be found on p. 25 of the Auxiliary Tables.

Any further discussion of the use of the tables would be superfluous. The missing details of the foregoing, concerning the creation, method of computation, accuracy, ensurance, etc. of the ten-place tables, as well as further questions of a more scientific nature are given in detail in the first volume of *Ten-Place Tables*.

P. 1. **Ten-place logarithms of trigonometric functions from 0° to 90° for every thousandth of a degree**

P. 902.

Correction

P. 85. In column d for log sin $4^0.182$ read 1036 515 instead of 1030 515.
P. 250. For log tang $12^0.412$, read 9.3425881420

VOLUME III

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Page 3

Correction to the First Difference

Horizontal argument: Second difference. Vertical argument: Phase

In the following table all interpolation can be avoided if an error of 2.5 units in the last place of the required logarithm is permissible. (Highest errors occur in the case of second differences near 1000 and in the case of large phases.) Then if, for example, the second difference is 986 and the phase 0.5143, one should take with the arguments 990 and 0.51 the round figure 243 instead of the rigorous value 240, as the "correction to the first difference."

Page		
4–23	Verbesserung der ersten Differenz	Correction of first difference
	Zweite Differenz	Second difference
	Phase	Phase

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Ten-Place Values of S and T

from $0^0.000$ to $2^0.100$

The auxiliary quantities S and T enable us to find, for the interval from $0^0.000$ to $2^0.100$, the ten-place logarithms of sin and tang, and to solve the converse problem. By definition:

$$S = \log \sin x - \log x$$
$$T = \log \tang x - \log x,$$

in which x is the number of degrees; whence

1) $\log \sin x = S + \log x, \quad \log \tang x = T + \log x$
2) $\log x = \log \sin x - S, \quad \log x = \log \tang x - T.$

Example 1

Let $x = 1^0.\ 993\ 41252$; required, log sin x.
From the ten-place table of logarithms, we find:

$$\log x = 0.299\ 5971\ 815.$$

On p. 45 of this table we find:

$$S = 8.241\ 7897\ 483,$$

hence log sin $x = 8.541\ 3869\ 298$.

Example 2

Given log sin x = 8.541 3869 298. Find x.

First we have to seek out an approximate value of x, and we take for such value from the ten-place logarithm table

$$x = 1^0.993\ 4126.$$

The corresponding S is taken from p. 45:

$$S = 8.241\ 7897\ 483;$$

thus we obtain log x = 0.299 5971 815,
whence by means of the ten-place logarithm table: $x = 1^0.993\ 41252$.

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Conversion Tables

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6. Conversion of degrees to time 62
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Examples

1) Convert 4.13569274829 to degrees:
2) Convert $236^0.957739840$ to radians:
3) Convert 57′ 27″.86342 to fractions of a degree:
4) Convert $0^0.95773984$ to minutes and seconds of arc:
5) Convert $15^h47^m49^s.857562$ to degrees:
6) Convert $236^0.95773984$ to time:
7) Convert $185^g.279368154$ to degrees:
8) Convert $166^0.751431339$ to grads:

Supplement of Additional Errata

Edited by Charles J. Hyman

Formerly Computer, U.S. Coast and Geodetic Survey

After the original publication of the Peters-Stein tables, a few of the table values were still found to be erroneous. The following contains the names of those responsible for the discovery of these errors, as well as the corrected values as given by them.

VOLUME I

Due to L. S. Comrie (*Mathematical Tables and Other Aids to Computation*, v. 1, p. 57–59):

P. 16. log 11275. For 506 *read* 505.
P. 406. log 69731. For 843 4358 934 *read* 843 4258 934.
P. 566. log 93748. For 974 9620 114 *read* 971 9620 114.

Page

Appendix to Volume I

VII Due to C. R. Cosens, Engineering Laboratory, Cambridge, England:

$$\text{For } \frac{B_3}{5 \cdot 6 \cdot n} \text{ read } \frac{B_3}{5 \cdot 6 \cdot n^5}.$$

Due to H. S. Uhler, Dept. of Physics, Yale University:

Natural Logarithms (82-place)

XXIV ln 23. Last digit should be 2.
ln 41. Last two digits should be 60.
ln 59. Last digit should be 4.
ln 61. Last digit should be 2.

XXV ln 71. Last two digits should be 60.
ln 73. Last digit should be 3.
ln 97. Last digit should be 3.
ln 103. Last digit should be 6.
ln 107. Last digit should be 6.

Ordinary Logarithms (84-place)

XXV log 17. Last digit should be 6.
log 23. „ „ „ „ 4.
log 41. „ „ „ „ 3.
log 61. „ „ „ „ 7.
log 71. „ „ „ „ 0.
log 83. „ „ „ „ 0.
log 97. „ „ „ „ 6.
log 101. „ „ „ „ 0.
log 113. „ „ „ „ 8.

Computation of log 127

XXVII 2 log 71. Last digit should be 0.
s_1. Last two digits should be 28.
2 log 23. Last digit should be 8.
2 log 41. Last digit should be 6.
s_2. Last digit should be 4.
log 127. Last two digits should be 14.

Computation of ln 127

2 ln 71. Last two digits should be 20.
s_1. Last digit should be 6.
ln 127. Last digit should be 6.

Table 1

NORC (Naval Ordnance Research Calculator) Computation of π:

P. 1. Beginning with row 9, column 2 (after 527th place) *read*:

39494 63952 24737 19070 21798 60943 70277 05392 17176 29317 67523 84674
81846 76694 05132 00056 81271 45263 56082 77857 71342 75778 96091 73637 17872
14684 40901 22495 34301 46549 58537 10507 92279 68925 89235 42019 96

P. 1.

Due to H. S. Uhler, Dept. of Physics, Yale University

P. 1. log π. The last place should be 5 instead of 6.

Communicated by J. Todd, National Bureau of Standards:

P. 2. C. In row 4, column 11, *read* 571 instead of 570.

Due to H. S. Uhler:

P. 7. M. Beginning with row 4, column 11, *read*: 17253 83562 22813 95603 05.
1: M. Beginning with row 4, column 11, *read*: 43651 55048 93.
ln M. At column 10, *read*: 63432 0083 — 10.

Communicated by J. Todd:

Table 3
P. 47. $1 : 42^n$. Row 5, columns 5, 6 should read: 85452 31863 76.

Communicated by J. Todd:

Table 10
P. 90. n = 25. Last column, for 70 *read* 71.

Due to E. B. Escott:

Table 13
P. 131. ln 829. Column 4 should read 97458.

Due to C. R. Cosens, Engineering Laboratory, Cambridge, England:

P. 132. ln 1087. Column 10 should read 597.
P. 151. ln 9883. Column 10 should read 193.

Due to A. Steinhauser,

Hilfstafeln zur präcisen Berechnung zwanzigstelliger Logarithmen
(Auxiliary Tables for Precise Computation of Twenty-place Logarithms):

P. 144. ln 6343. Column 3 should read 33897.

Due to P. Gray, *Tables for the Formation of Logarithms:*

P. 133. ln 1409. Column 4 should read 21696.

Due to F. J. Duarte, *Nouvelles Tables Logarithmiques à 36 Decimales:*

Table 13

P. 138. ln 3967. Column 6 should read 91389.
145. ln 7247. „ 7 „ „ 25102.
149. ln 8837. „ 4 „ „ 42354.
149. ln 8963. „ 7 „ „ 38153.
150. ln 9623. „ 4 „ „ 83305.

Due to H. S. Uhler:

P. 151. ln $(1 - 9 \cdot 10^{-4})$. Last column should read 486.
7 „ „ „ „ 860.
5 „ „ „ „ 786.
2 „ „ „ „ 810.
1 „ „ „ „ 735.

ln $(1 - 8 \cdot 10^{-5})$. „ „ „ „ 614.
6 „ „ „ „ 808.
5 „ „ „ „ 845.
4 „ „ „ „ 445.
3 „ „ „ „ 773.
1 „ „ „ „ 683.

ln $(1 - 9 \cdot 10^{-6})$. „ „ „ „ 597.
8 „ „ „ „ 357.
7 „ „ „ „ 605.
5 „ „ „ „ 447.
1 „ „ „ „ 857.

P. 152. ln $(1 + 8 \cdot 10^{-4})$. „ „ „ „ 566.
5 „ „ „ „ 339.
1 „ „ „ „ 401.

ln $(1 + 8 \cdot 10^{-5})$. „ „ „ „ 797.
5 „ „ „ „ 981.

ln $(1 + 5 \cdot 10^{-6})$. „ „ „ „ 458.
1 „ „ „ „ 524.

ln 2. Row 4, Columns 11–13 should read 30070 95326 37.
ln 3. Row 4, „ 11–13 „ „ 68975 60690 11.
ln 5. Row 4, „ 11–13 „ „ 13580 59722 57.
ln 7. Row 4. „ 11–13 „ „ 74183 10810 25.

Table 14b

P. 156. N = 31. Last digit should be 7.
N = 43. ,, ,, ,, ,, 4.
N = 47. ,, ,, ,, ,, 5.
P. 157. N = 59. ,, ,, ,, ,, 6.
P. 158. N = 127. ,, ,, ,, ,, 3.
N = 227. Column 12, *read* 49565.
N = 293. Last digit should be 4.
P. 160. N = 839. Column 12, *read* 53874.
N = 1009. Column 12, *read* 38228.
P. 161. N = 1097. Columns 12–13, *read* 00941 7.

VOLUME II

Due to A. D. Sollins, *U.S. Coast and Geodetic Survey:*

On p. 762, $38^0.000 - 38^0.050$, the third digit from the left in the difference column for log tang and log cotg should be 6 instead of 7. Thus for the first difference read 156237, not 157237. The error persists for the entire page.